# FISHERIES in the ECONOMIES
## of Pacific Island Countries and Territories
(Benefish Study 4)

## La PÊCHE dans l'ÉCONOMIE
des États et Territoires insulaires océaniens

Robert GILLETT
Merelesita FONG

Pacific Community
Communauté du Pacifique

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# Contents

# Foreword

It is with great pleasure that I present the latest edition of *Fisheries in the Economies of Pacific Island Countries and Territories*. This publication serves as a comprehensive assessment of the critical role that fisheries play in the food security and economies of Pacific Island countries and territories (PICTs). In recent years, the significance of fisheries has been widely acknowledged, yet access to up-to-date economic and benefit information has often been challenging to obtain. This edition aims to help bridge that gap by providing the best available data and information in one place and takes into account the ongoing impacts of COVID-19 and climate change.

Maintaining accurate and up-to-date information on the impact of fisheries is essential for informed decision-making and sustainable development but acquiring reliable data on the value and multifaceted contributions of fisheries to our economies has been a persistent challenge. Two decades ago, recognising this information deficit, the Asian Development Bank, in collaboration with the World Bank, the Australian Government, the Pacific Community (SPC), and the Pacific Islands Forum Fisheries Agency (FFA), initiated efforts to address this issue, in what eventually became known as the Benefish studies. Each one has examined six distinct types of fisheries: coastal commercial; coastal subsistence; offshore locally based; offshore foreign-based; freshwater; and aquaculture. For each of these fisheries, estimates were made of fish production and five key benefits: contributions to gross domestic product (GDP), exports, government revenue, employment, and food supplies.

Building upon the valuable insights gained from the first and second studies conducted in 2001 and 2007, and in response to growing demand for up-to-date data on the contribution of fisheries to PICT economies, SPC assumed the role of the lead agency and publisher of the findings of the 2016 study, and again for the present work. The current study involved the collection of information from all PICTs over the period from September 2022 to late January 2023. Unlike its predecessors, this study includes an examination of the impacts of the COVID-19 pandemic and climate change on fisheries, acknowledging the evolving challenges our region has, and continues to face. Further, in this most recent study, SPC began to develop Pacific capacity to conduct a very necessary update in five years.

This edition of *Fisheries in the Economies of Pacific Island Countries and Territories* presents the results through country chapters, offering a deeper understanding of the unique circumstances and challenges faced by each nation. Additionally, comparative analyses between countries provide valuable insights into regional trends and will facilitate informed decision-making at both national and regional levels. The concluding chapters synthesise the overarching themes and implications of the study, offering valuable recommendations for sustainable fisheries development.

I would like to draw your attention to three major findings that have emerged from this study, which hold significant implications for the sustainable development and management of fisheries in the Pacific region:

First, **the need for increased dialogue between staff of national fisheries agencies and staff of national statistics offices**. Enhanced interaction between these two agencies is crucial to improving the quality and availability of fisheries data. As such, a key priority arising from this study is the development of mechanisms to encourage and facilitate the desired cooperation. By fostering collaboration and knowledge exchange between these entities, we can enhance the accuracy and reliability of fisheries data, laying the foundation for better evidence-based decision-making.

Second, **the expansion of access fees for foreign fishing has been substantial between 2007 and 2021**. This growth can be attributed, in large part, to the introduction of the Vessel Day Scheme for the management of purse seine fisheries in the region. However, it is important to acknowledge that the continuous increase in regional tuna catches and associated access fees cannot be sustained forever and thus there is a pressing need to diversify the benefits derived from offshore fisheries. For example, expanding the local basing of fishing operations to enhance GDP contributions, exploring new export opportunities, promoting employment opportunities, and strengthening food systems. These efforts should receive increased attention – similar to past endeavours to expand catches and increase access fees – to ensure a more balanced and resilient fishery sector.

Last, **there has been a substantial decline in the per capita supply of fish from coastal fisheries between 2007 and 2021**. These fisheries play a vital role in providing the majority of fish consumed by residents of PICTs. This decline is cause for major concern, as it not only impacts food security but also has far-reaching socio-economic consequences for coastal communities. Addressing the challenges faced by coastal fisheries and ensuring their sustainable management should be a top priority, with a focus on community engagement, sustainable resource use, and adaptive management approaches.

I encourage policymakers, researchers, and stakeholders to utilise this studys' insights to drive evidence-based decision-making and implement targeted interventions that promote the sustainable development of fisheries in the Pacific Islands region.

Only together can we ensure the long-term prosperity of our communities and the preservation of our region's invaluable fisheries resources.

***Dr Stuart Minchin***
*Director-General*
*Pacific Community (SPC)*

# About the Authors

Robert Gillett (rgillett1@yahoo.com) began his fisheries career in 1977 with SPC's Skipjack Survey and Assessment Programme, in which tuna and baitfish resources were investigated in all 22 SPC member countries and territories. After eight years with SPC, he worked for eight years on the Regional Fisheries Support Programme of the Food and Agriculture Organization of the United Nations in the development and management of fisheries in the independent Pacific Island countries. In 1995 he and Garry Preston founded Gillett, Preston and Associates, which has been involved in marine resources development in the Pacific region and beyond for almost four decades. Although Mr Gillett has focused on the Pacific Island region, he has worked in 50 countries. Mr Gillett has been employed by UN agencies, regional organisations, multilateral development banks, universities, research foundations, NGOs and national governments. He has authored more than 350 publications, books and technical reports on fisheries.

Merelesita Fong (merelesitaafong@gmail.com) graduated with a BSc in Marine Science from the University of the South Pacific after four years of studying. Throughout those years, she actively participated in various volunteer and ocean conservation activities with organisations such as WWF, Uto ni Yalo, Pacific Ocean Litter Youth Project and the Wantok Moana Association. After graduating in 2021, Ms. Fong assisted three students with their PhD research. In late 2022 she began her work with Robert Gillet in compiling the fourth edition of the Benefish study.

# Acknowledgements

Well over 100 people contributed information, insight and advice to this study. Special thanks go to the senior officers of the government fisheries agencies and statistics offices for their support.

At SPC, the Division of Fisheries, Aquaculture and Marine Ecosystems nurtured the idea of a fourth Benefish study, organised the funding, made administrative arrangements for the work, provided logistical support and had just the right touch in managing the study – that is, providing assistance when needed but giving the consultants considerable freedom in carrying out the work. SPC's Statistics for Development Division greatly facilitated the study through introductions to national statistical contacts, providing help understanding surveys and provision of data.

At FFA, the economic team provided invaluable assistance on several different levels, including encouragement, documentation, explanation of various types of analysis, pricing information and access to their data collectors.

Several people reviewed sections of this book. Ian Cartwright was the overall reviewer of the analytical chapters. Other reviewers were Maurice Brownjohn, Garry Preston, Mike Batty, Kelvin Passfield, Jeff Kinch, Mike Savins, Mike McCoy, Marlowe Sabater, Nathan Van Ee and Sangeeta Mangubhai.

The advice kindly provided by Les Clark during the first Benefish study still resonates in this book.

# Abbreviations

| | |
|---|---|
| ADB | Asian Development Bank |
| AusAID | Australian Agency for International Development |
| BEA | Bureau of Economic Analysis (of the U.S. Department of Commerce) |
| BMR | Bureau of Marine Resources (of Palau) |
| CBSI | Central Bank of the Solomon Islands |
| CITES | Convention on the International Trade of Endangered Species |
| CNMI | Commonwealth of the Northern Mariana Islands |
| CoFish | Pacific Regional Coastal Fisheries Development Programme |
| Cospi | Commercialisation of Seaweed Production in the Solomon Islands |
| CPI | consumer price index |
| CPPL | Central Pacific Producers Ltd. (of Kiribati) |
| DAM | Direction des Affaires Maritimes (of New Caledonia) |
| DevFish | Development of Tuna Fisheries in the Pacific ACP Countries |
| DFAT | Department of Foreign Affairs and Trade (of Australia) |
| DMWR | Department of Marine and Wildlife Resources (of American Samoa) |
| DRM | Direction des Ressources Marines (of French Polynesia) (formerly DRMM, Direction des Ressources Marines et Minières) |
| DSA | Direction des Services de l'agriculture, de la forêt et de la pêche |
| EEZ | exclusive economic zone |
| ENSO | El Niño-Southern Oscillation |
| EPPSO | Economic Planning Policy and Statistics Office (of Marshall Islands) |
| FAD | fish aggregation device |
| FAME | Division of Fisheries, Aquaculture and Marine Ecosystems (of SPC) |
| FAO | Food and Agriculture Organization of the United Nations |
| FFA | Forum Fisheries Agency |
| FOB | free on board |
| FSM | Federated States of Micronesia |
| FTE | full-time equivalent |
| FY | fiscal year, financial year |
| GDP | gross domestic product |
| GNI | gross national income (formerly, GNP) |
| GNP | gross national product |

| | |
|---|---|
| GO | gross output |
| GRT | gross registered tonnage |
| HIES | household income and expenditure survey |
| hp | horsepower |
| HS | Harmonized Commodity Description and Coding System |
| IC | intermediate consumption |
| IEOM | Institut d'Émission d'Outre-mer |
| IMF | International Monetary Fund |
| ISEE | Institut de la Statistique et des Études Économiques (of New Caledonia) |
| ISIC | International Standard Industrial Classification of All Industrial Activities |
| ISPF | Institut de la Statistique de la Polynésie française |
| JICA | Japan International Cooperation Agency |
| kg | kilogram |
| km | kilometre |
| MACBIO | Marine and Coastal Biodiversity Management in Pacific Island Countries |
| MFMR | Ministry of Fisheries and Marine Resources (of Solomon Islands) |
| MIMRA | Marshall Islands Marine Resources Authority |
| MMDC | Micronesian Mariculture Demonstration Center |
| MMR | Ministry of Marine Resources (of the Cook Islands) |
| MPA | marine protected area |
| NEPO | National Economic Planning Office |
| NFA | National Fisheries Authority (of PNG) |
| NFMRA | Nauru Fisheries and Marine Resources Authority |
| NIMRF | Nago Island Mariculture and Research Facility (of PNG) |
| NMFS | National Marine Fisheries Service (of the United States) |
| NOAA | National Oceanic and Atmospheric Administration |
| NORMA | National Oceanic Resource Management Authority (of FSM) |
| NSO | National Statistics Office (of PNG) |
| OFCF | Overseas Fisheries Cooperation Foundation (of Japan) |
| PAFCO | Pacific Fishing Company (of Fiji) |
| PCS | Palau Conservation Society |
| pcs | pieces |

| | |
|---|---|
| PICTs | Pacific Island countries and territories |
| PIFTAC | Pacific Island Financial Technical Assistance Centre (of the IMF) |
| PMDC | Palau Mariculture Demonstration Center |
| PNA | Parties to the Nauru Agreement |
| PNG | Papua New Guinea |
| PROCFish | Pacific Regional Oceanic and Coastal Fisheries Development Programme (PROCFish/C/CoFish) |
| RMI | Republic of the Marshall Islands |
| SDD | Statistics for Development Division (of SPC) |
| SINSO | Solomon Islands National Statistics Office |
| SNA | System of National Accounts |
| SPC | Pacific Community (formerly Secretariat of the Pacific Community) |
| t | tonne (1 tonne = 1 metric ton = 1,000 kg) |
| TDS | Tonga Statistics Department |
| TFD | Tuvalu Fisheries Department |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| U.S. | United States |
| VA | value added |
| VAR | value-added ratio |
| VDS | vessel day scheme |
| VFD | Vanuatu Fisheries Department |
| VISR | Vanuatu International Shipping Registry |
| VNSO | Vanuatu National Statistics Office |
| WCPFC | Western and Central Pacific Fisheries Commission |
| WCPO | western and central Pacific Ocean |
| WCS | Wildlife Conservation Society |
| WPacFIN | Western Pacific Fisheries Information Network |

# Currency Equivalents

The average yearly exchange rates (relative to the US dollar – US$) used in this book are as follows:

| | Australia (A$) | New Zealand (NZ$) | Papua New Guinea (K) | Solomon Islands (SI$) | French Territories (XPF) | Vanuatu (VT) | Fiji Islands (F$) | Tonga (T$) | Samoa (ST$) |
|---|---|---|---|---|---|---|---|---|---|
| 2000 | 1.74 | 2.19 | 2.76 | 5.09 | 130 | 137.8 | 2.13 | 1.64 | 3.27 |
| 2001 | 1.95 | 2.38 | 3.36 | 5.28 | 133 | 145.7 | 2.33 | 1.95 | 3.47 |
| 2002 | 1.83 | 2.15 | 3.89 | 6.75 | 127 | 139.1 | 2.15 | 2.18 | 3.37 |
| 2003 | 1.52 | 1.72 | 3.55 | 7.51 | 106 | 122.2 | 1.85 | 2.19 | 3 |
| 2004 | 1.36 | 1.51 | 3.22 | 7.48 | 96 | 111.9 | 1.73 | 2.04 | 2.78 |
| 2005 | 1.31 | 1.42 | 3.1 | 7.53 | 96 | 109 | 1.7 | 1.93 | 2.71 |
| 2006 | 1.32 | 1.54 | 3.06 | 7.61 | 95 | 110 | 1.73 | 2.01 | 2.78 |
| 2007 | 1.19 | 1.36 | 2.96 | 7.65 | 87 | 104 | 1.6 | 2.02 | 2.62 |
| 2008 | 1.1 | 1.32 | 2.77 | 7.67 | 80 | 96.77 | 1.51 | 1.85 | 2.52 |
| 2009 | 1.12 | 1.39 | 2.65 | 7.88 | 83.22 | 99.72 | 1.92 | 1.9 | 2.5 |
| 2010 | 0.1 | 1.3 | 2.63 | 7.85 | 90.27 | 95.24 | 1.81 | 1.81 | 2.35 |
| 2011 | 0.98 | 1.29 | 2.13 | 7.24 | 92.16 | 95.43 | 1.84 | 1.73 | 2.36 |
| 2012 | 0.96 | 1.21 | 2.07 | 7.07 | 89.88 | 93.51 | 1.79 | 1.74 | 2.28 |
| 2013 | 1.12 | 1.22 | 2.42 | 7.19 | 86.01 | 96.02 | 1.88 | 1.85 | 2.33 |
| 2014 | 1.22 | 1.28 | 2.57 | 7.63 | 98.13 | 102.51 | 1.98 | 1.86 | 2.39 |
| 2015 | 1.37 | 1.47 | 2.98 | 8.16 | 108.81 | 109.57 | 2.13 | 2.20 | 2.58 |
| 2016 | 1.37 | 1.44 | 3.25 | 7.99 | 114.17 | 110.50 | 2.13 | 2.31 | 2.61 |
| 2017 | 1.29 | 1.42 | 3.25 | 7.75 | 99.42 | 105.92 | 2.06 | 2.22 | 2.55 |
| 2018 | 1.42 | 1.48 | 3.25 | 8.02 | 104.39 | 113.97 | 2.13 | 2.24 | 2.62 |
| 2019 | 1.44 | 1.50 | 3.41 | 8.30 | 106.78 | 116.05 | 2.16 | 2.35 | 2.67 |
| 2020 | 1.32 | 1.40 | 3.51 | 8.02 | 98.00 | 109.30 | 2.05 | 2.28 | 2.53 |
| 2021 | 1.38 | 1.47 | 3.51 | 8.05 | 105.37 | 113.07 | 2.12 | 2.28 | 2.59 |
| 2022 | 1.53 | 1.74 | 3.52 | 8.19 | 120.27 | 122.77 | 2.28 | 2.41 | 2.80 |

Unless otherwise indicated, the term "$" in this book refers to the US dollar.

# 1 Executive Summary

## Background

In 2001 and 2008 the Asian Development Bank undertook studies to quantify benefits from the fisheries sectors of Pacific Island countries (the "Benefish studies"). Summaries of the reports of those studies are given in Appendix 1 of the present report.

In early 2014 discussions between the Pacific Community (SPC) and the Australian Department of Foreign Affairs and Trade (DFAT) resulted in an agreement to sponsor an update of the earlier publications. A consultant was recruited, the fieldwork to collect information began in early August 2014 and was completed in early November. Country-specific information was assembled, analysed and written up from mid-November to late January, with the main text of the report produced in February 2016. A summary of that report is also given in Appendix 1 of the present report.

In mid-2022 SPC discussed the possibility of another Benefish study with the author of the past Benefish studies. Arrangements were agreed upon, and work began in early September. Information collection was completed in January 2023, and analysis and writing took place from January to April.

## The content of this report

This report contains a fisheries-oriented discussion of macroeconomics, country information on specific topics (fisheries production, contribution to gross domestic product [GDP], etc.), a discussion of important topics across all countries (e.g. the regional significance of access and exports of fishery products), comparisons with results of previous Benefish studies, some important features of the benefits from fisheries that have emerged from this study, and recommendations on improving the measurement of fisheries benefits and assuring the continuity of those benefits.

## GDP, fishing and fisheries

Background information on estimating GDP is provided, along with guidelines on estimating the fishing contribution to GDP.

An important point is that for national accounting purposes, the sector is "fishing", rather than the more inclusive "fisheries". Thus, post-harvest activities, including fish processing, are not included in the fishing sector when estimating GDP.

## Country data on fisheries benefits

Information on benefits from fisheries is provided for each of the 22 Pacific Island countries and territories. These country sections contain recent, readily available data for the following areas:

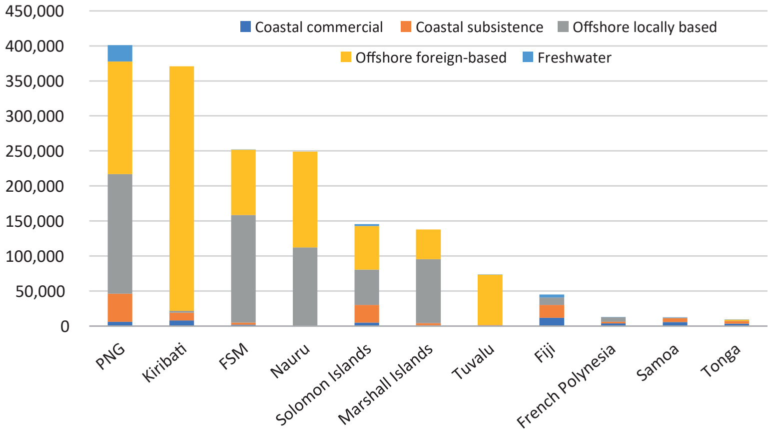
- Annual fishery harvests: values and volumes covering the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing and (6) aquaculture.
- Fishing contribution to GDP: the current fishing contribution, how it was calculated, and re-calculation based on annual harvest levels obtained during the study.
- Fishery exports: amounts, types and the ratio to all exports.
- Government revenue from the fisheries sector: access fees and other revenue.
- Fisheries employment.
- Fisheries contribution to nutrition.

## Regional fisheries and aquaculture production information

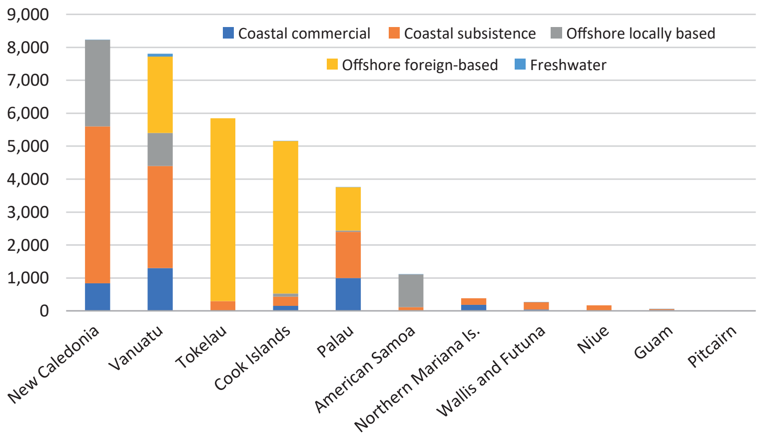
The total fishery and aquaculture production of the zones of the 22 Pacific Island countries and territories in 2021 is estimated to be about 1.56 million tonnes (t), worth about US$2.50 billion. The total volume of fishery production in the region in the period between 2007 and 2021 increased by 293,565 t, or 20.3%.

In comparing these figures to estimates by other studies, it is important to note carefully how the "region" is defined and where on the value chain the value is estimated. The present study defines the region as the 22 Pacific Island countries and territories (PICTs) and their 200-mile zones. The values used are the prices paid to the producer or (for offshore fisheries) in-zone prices.

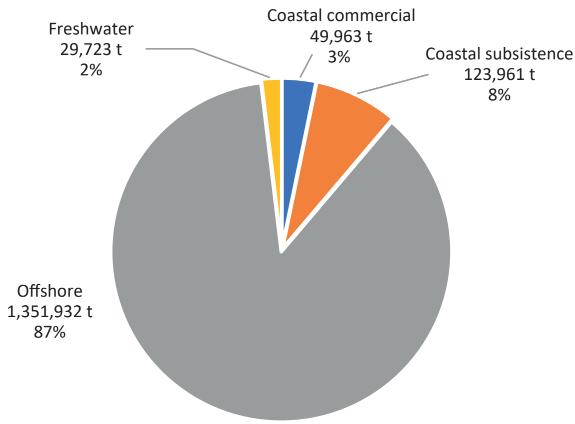
It is also important to note that 2021 was a Covid year, and the production of several fisheries in the region was depressed.



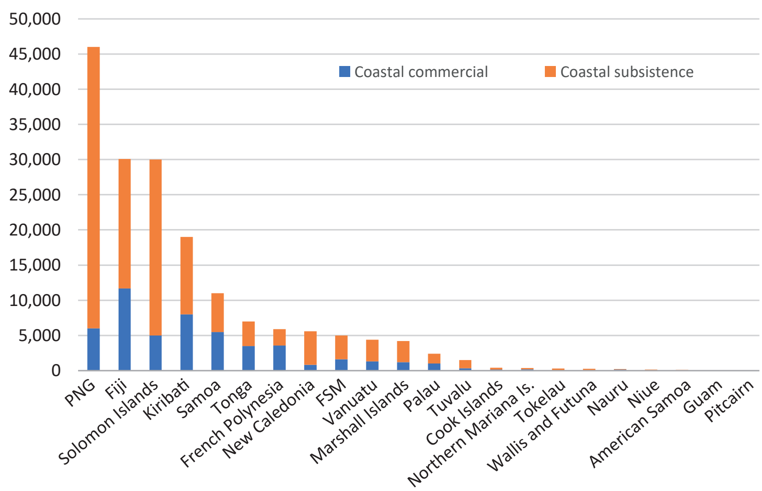

Volume of fishery production in 2021 in the higher-producing countries (t)




Volume of fishery production in 2021 in the lower-producing countries (t)




Share of regional fishery production volume for the various fishery categories (excluding aquaculture) in 2021




Coastal fishery production volume in 2021 for each country/territory (t)

## Some notable features of the region's overall 2021 fishery production

- The total production from the region in 2021 (1,555,579 t) divided by the population of the region in 2021 (12,530,000 people) equates to 124 kg of fish per person.
- Considering that the coastal fisheries provide the vast majority of fish from the region for consumption by residents of PICTs (i.e. almost all the production from offshore fisheries in the region is shipped out of the region), the annual per capita supply of coastal fish is crucially important. In 2021 this supply was 13.8 kg per capita.
- Whether a PICT is among the "top producing countries" is strongly determined by its offshore fisheries production.
- Aquaculture production is only relatively important in two places, French Polynesia and New Caledonia.
- Freshwater fisheries are only relatively important in one place, Papua New Guinea (PNG).

## Some features of coastal fisheries production in 2021

- The volume for all coastal fisheries (commercial and subsistence) in PNG is about one quarter of the regional total.
- The production from Fiji's coastal commercial fisheries is greater than from any other PICT, even PNG which has a population almost nine times greater. Even considering coastal populations (those that reside within 20 km of the coast: 2,723,214 in PNG and 819,343 in Fiji), Fiji's coastal commercial production is almost twice as much, despite having less than a third of the coastal population.
- The degree of commercialisation of the coastal fisheries of Tonga and Samoa (i.e. the ratio of commercial to subsistence) appears to be surprisingly high.
- The degree of commercialisation of the coastal fisheries of New Caledonia and American Samoa appears to be surprisingly low.

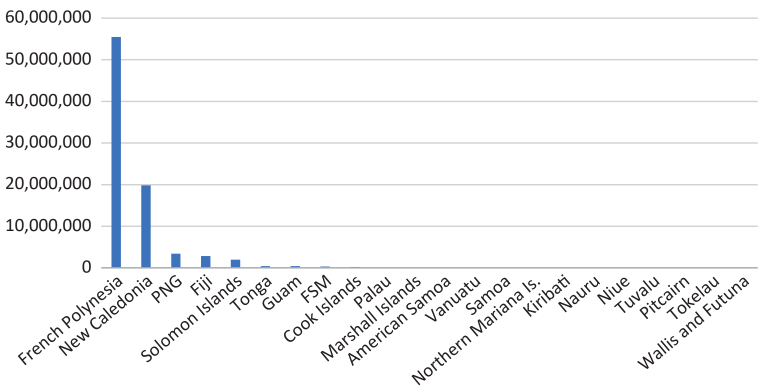
## Some features of offshore fisheries production in 2021

- The volume of production from offshore fishing (locally based and foreign-based) in the Kiribati zone in 2021 (352,031 t) is greater than any other PICT in the region, despite 2021 not being an El Niño year.

- Two countries in an area of relatively good tuna fishing had almost no locally based offshore fishery production in 2021: Kiribati and Tuvalu.
- In about one third of the countries that are significantly involved in offshore fisheries, the fleet is all locally based; in one third, it is a mixture of locally and foreign based; and in one third, it is all foreign based.
- Almost half of the PICTs in the region have no offshore foreign-based fishing. The main reasons for this are the policies of the metropolitan country to which a territory is affiliated (4 territories), a desire to protect domestic fleets (2 countries, 2 territories), the zone being a large marine protected area (1 territory) and being located away from prime fishing areas (1 country).
- Although Palau is a member of the Parties to the Nauru Agreement (PNA), the production from its offshore fishing is lower than that from six non-PNA countries.

## Aquaculture production in the region in 2021

In 2021 aquaculture production in the region was estimated at 7,573 t and 8,825,931 pieces, worth US$85,270,108 (3.4% of the value of all fisheries and aquaculture in the region).




Value of aquaculture production by countries and territories in 2021 (US$)

The leading aquaculture activities in 2021

| Activity | Value of production (US$ millions) |
|---|---|
| Pearls in French Polynesia | 50.2 |
| Shrimp in New Caledonia | 18.5 |
| Shrimp in French Polynesia | 3.2 |
| Tilapia in PNG | 2.4 |
| Seaweed in Solomon Islands | 1.9 |
| Pearls in Fiji | 1.4 |
| Tilapia in Fiji | 1.0 |

### Some comments about aquaculture in the region in 2021

A number of features are notable:

- Two French territories were responsible for 88.3% of the value of all aquaculture production in the region in 2021.
- Five PICTs have aquaculture production worth more than US$500,000.
- Aquaculture production is significant (i.e. annual production worth more than US$50,000) in only 11 of the 22 PICTs.
- One of the most remarkable points about aquaculture in the region is the lack of knowledge of the overall aquaculture production in almost every PICT.

## Changes in fisheries production since 2007

Changes in fisheries production: Regional totals in each fishery category, 2014 vs 2021 (t)

| | Coastal commercial | Coastal subsistence | Offshore locally based | Offshore foreign-based | Freshwater | Total |
|---|---|---|---|---|---|---|
| **2007** | 44,789 | 109,933 | 401,096 | 864,685 | 23,858 | **1,446,368** |
| **2014** | 53,753 | 110,183 | 420,550 | 1,445,984 | 26,245 | **2,058,729** |
| **2021** | 49,963 | 123,961 | 603,888 | 932,398 | 29,723 | **1,739,933** |

The following is notable:

- The total fisheries production volume of the region declined between 2014 and 2021, with much of the decline likely to be due to the impacts of Covid.
- In the 22 countries and territories, the combined real value (expressed in 2021 prices) of all six categories of fishery and aquaculture production was about the same in 2021 as it was in 2007.

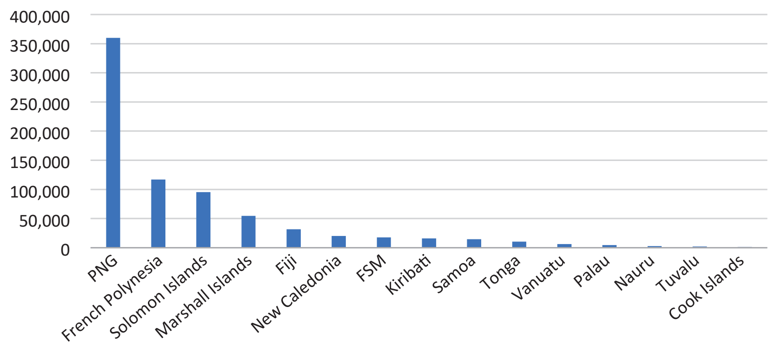
## Measuring fisheries production

The situation for measuring the production of offshore fisheries in the region is very different to that for coastal fisheries. Overall, offshore statistical systems are in relatively good condition at both national and regional levels. However, the coastal fishery statistical systems are not nearly as good. Typically, government fishery agencies give low priority to collecting data on coastal catches, which are also far more challenging to estimate. In general, the smaller the scale of the fishing, the less is known about the production levels, with quantitative information being especially scarce for subsistence fisheries in most countries.

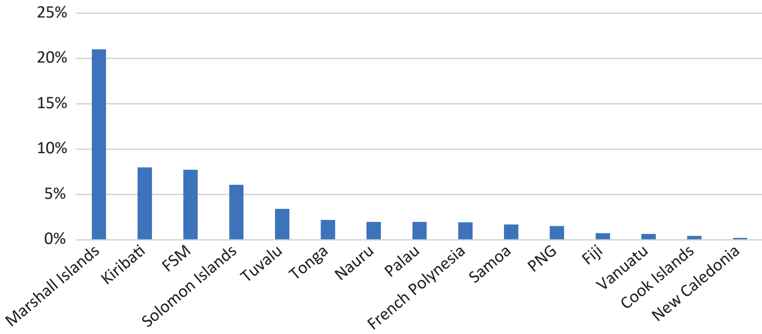
Many of the country and territory chapters in this book contain the remark: "The extremely weak factual basis for the estimates of coastal commercial and coastal subsistence catches is recognised." In some respects, this situation is a tragedy. The importance of food security and the role played by coastal fisheries are beyond dispute, but to effectively safeguard the flow of food from coastal fisheries, it is essential that the flow is quantified. The axiom that "you can manage what you can measure" (as well as its converse) certainly applies.

## The fishing contribution to GDP

In the country sections of this book, the official GDP and the official fishing contribution to GDP are given. Methods used in the official calculation of the fishing contribution to GDP are also presented (when available), and some comments are made on the suitability of those methods.



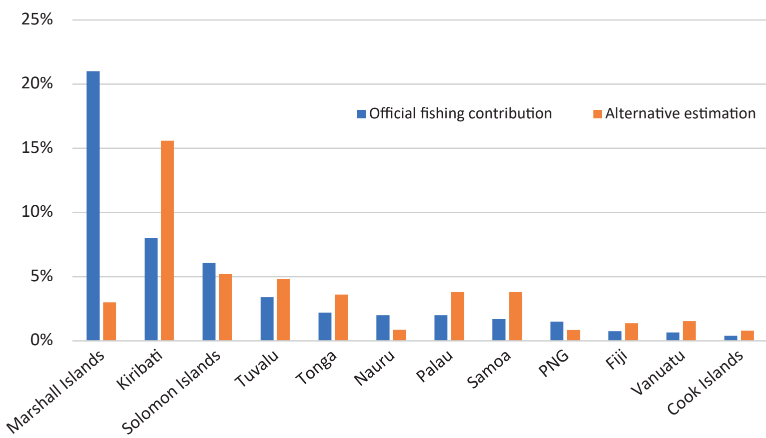

The official fishing contribution to GDP (US$ thousands; 2021 or latest year available)




The percentage contribution of fishing to official GDP

## An alternative estimate of fishing contribution to GDP

As part of the present study, a re-estimate was made for the fishing contribution to GDP in each country. This represents an alternative to the official method of estimating fishing contribution to GDP. It is not intended that the re-estimate replace the official methodology, but rather the results can serve as comparator to gain additional information on the appropriateness and accuracy of the official methodology – and possibly a need for modification.




Official vs alternative estimations of fishing contributions to GDP
(fishing contribution as a percentage of GDP)

## Some of the reasons for the differences between the official and alternative estimates

On a general level, some of the reasons for the differences are:

- Including or excluding the activities of locally based foreign fishing vessels.
- The official estimates omitting certain important fisheries.
- The GDP contribution from small-scale fishing (coastal commercial and subsistence fishing) is often quite different between the official and re-estimate. In some cases, it is because estimates of value of production differ and in others, it is due to the value-added ratio being different.
- Estimating production from the "informal" and "specialised" studies of the fishing sector in the official method often produces very different results from that obtained from the present study.
- The compilers of national accounts do not appear to have consulted the relevant fisheries agencies or the fishing industry when preparing their estimates.

## Improving the estimate of fishing contribution to GDP

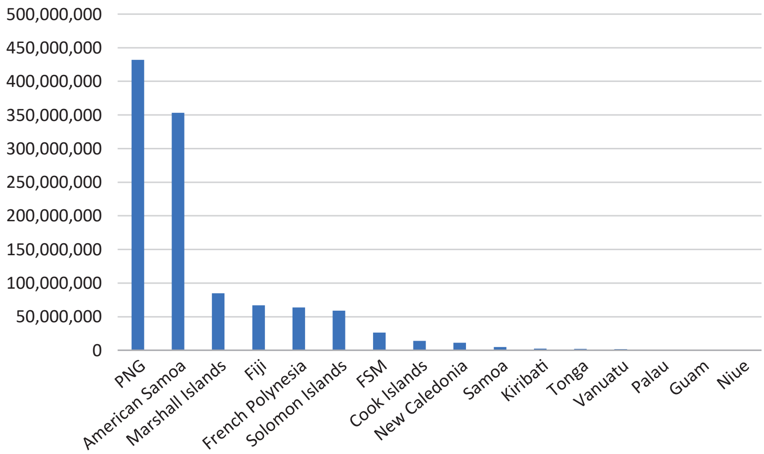
Based on the experience gained in the four Benefish studies, two of the most practical ways for the staff of a statistics department to improve the estimates of fishing contribution to GDP are for those staff to:

- Compare the re-estimated fishing contributions in the country sections of this report to the official estimate and evaluate the differences and any need for modification to the methodology.
- Use the available technical expertise in fisheries when devising methodology, collecting data, making the estimate and reviewing the results. In addition to the government fisheries agencies, such expertise can be found in the regional agencies involved with fisheries, especially the Forum Fisheries Agency (FFA) and SPC.

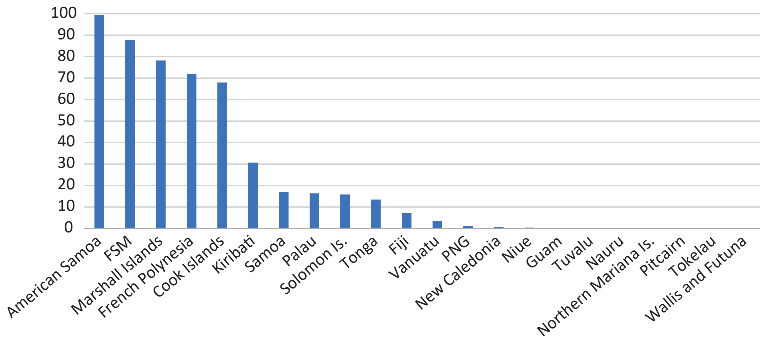
In the longer term – and on the level of the institutions supporting Pacific Island fisheries – there is some assistance that would be of considerable value in the interface between the fishing sector and national accounts. It is suggested that four issues be addressed: (1) value-added ratios, (2) the GDP status of locally based foreign fleets, (3) the blurring of the distinction between locally based and foreign-based offshore vessels and (4) the value of a satellite account for fisheries.

## The export of fishery products

The readily available information on the export of fishery products is presented in the country chapters and is summarised in a table in the Exports of Fishery Products chapter.




Nominal values in US$ of fishery exports (data are for 2021, except where otherwise noted in the country chapters)




The relative importance of fishery exports (% of all exports)

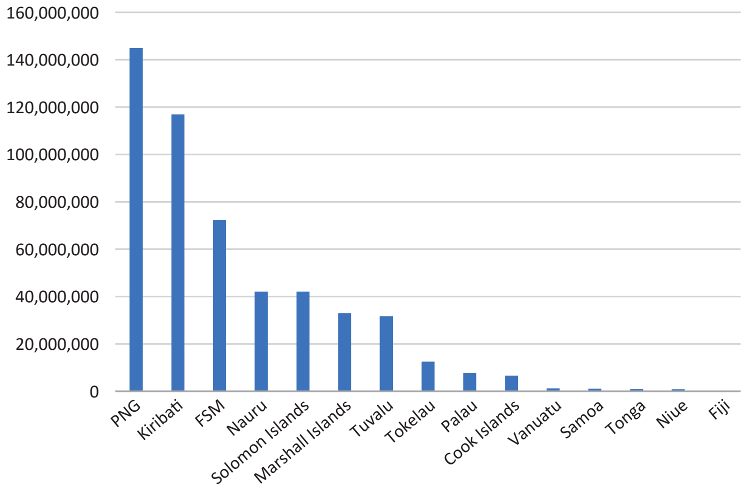
## Some notable points on the exports

- In five of the countries/territories, fishery exports represent over 70% of the value of all exports.
- The PICTs that have the largest values of fishery exports are American Samoa and PNG. Of the total of about US$1.1 billion in fishery exports from the region in 2021, about 70% is from these two places.
- The value of PNG's fishery exports is about 38% of the fishery exports from all of the PICTs combined. American Samoa's fishery exports are about 31% of the fishery exports from all the PICTs combined.
- The fishery exports of several countries/territories are very small or non-existent.
- Some large exporters of fishery products are countries or territories that export substantial amounts of other commodities (e.g. PNG and New Caledonia), making their fishery exports, although large, appear small in comparison to all their exports.
- Some large exporters of fishery products are countries/territories that export only small amounts of other commodities: the Marshall Islands, French Polynesia and the Federated States of Micronesia (FSM).

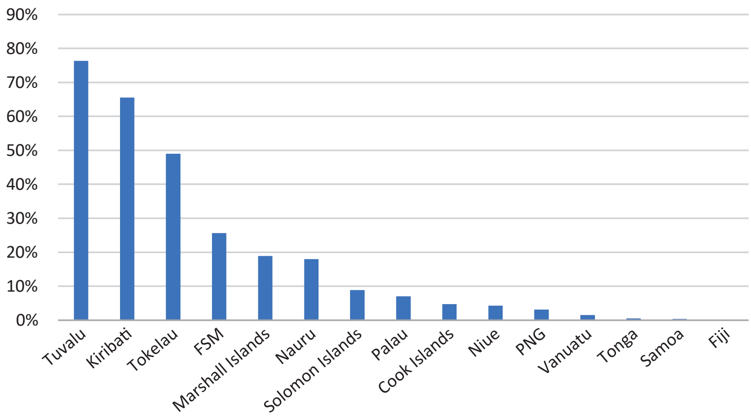
## Changes in the value of exports 2014–2021

- The total amount of fishery exports from the entire region increased in real value by about 20% over the 2014–2021 period.
- This increase is remarkable considering that 2021 (a) was in the Covid period; (b) sea cucumber, a very high-priced commodity, was not harvested in that year in most PICTs; and (c) exports from the cannery in American Samoa fell substantially in 2021.
- The rise in value of the fishery exports of PNG (up US$278 million) was responsible for about 68% of the rise in value of exports from the region. This issue is further explored in the PNG chapter.

# Access fees for foreign fishing



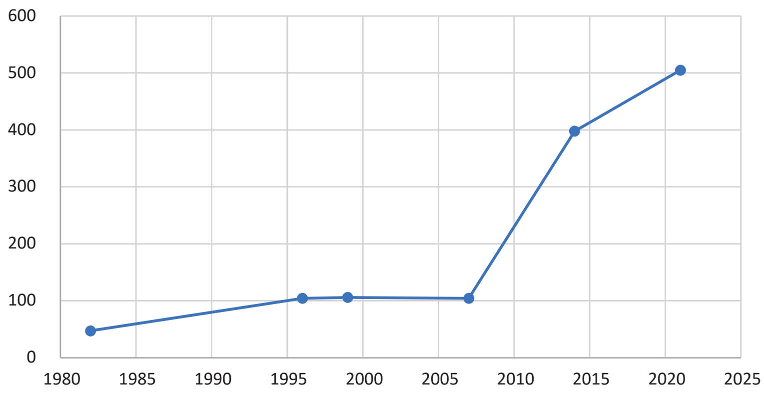

Access fees in US$ (2021 or latest year available)




Access fees as a percentage of total government revenue (2021 or most recent year available)

### Observations on the graphs

- For the year 2021, offshore fishing access generated a total of US$514,795,325 in revenue for the 22 PICTs.
- Because there are no offshore access fees in most territories, the access revenue-generating PICTs are the independent Pacific Island countries plus Tokelau.
- The top seven countries in terms of access fee generation are all PNA members and mostly small countries located in the equatorial region.
- PNG and Kiribati together are responsible for over half of the regional access fees.
- Although PNG obtains the most access fees of any PICT, the country is relatively low on the scale of access fees as a percentage of government revenue due to the large size of the PNG economy.
- For the PICTs in which access fees were responsible for more than 10% of government revenue, almost all are countries made up of atolls.




Real change in offshore access fees 1982–2021 (US$ millions)

## Fisheries employment

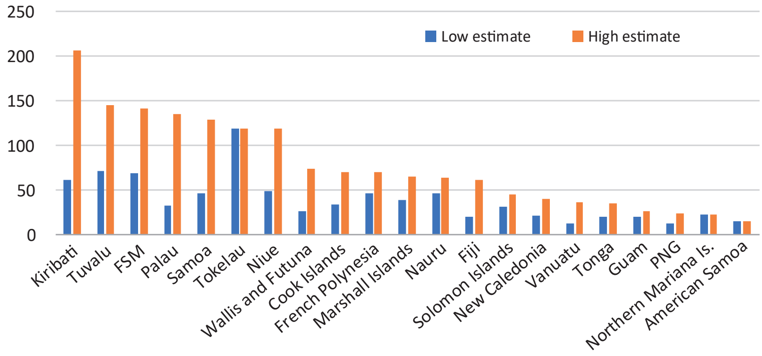
The employment information presented in the country and territory chapters is a heterogeneous collection of various types of data. The reality is that fisheries employment is harder to measure than other forms of fisheries benefits (GDP, exports, nutrition, etc.) Three difficulties are especially troublesome and require attention to make fisheries employment data more useful:

- The term "household participation in fisheries" is the most common metric for fisheries employment in the region. At least 14 PICTs collect and report on household participation in fisheries (number or percentage), but in most survey reports, the term is not defined – and where it is, the definition is often different from that used in neighbouring countries.
- Another problem area in measuring fisheries employment in the region is aggregating the data on fisheries employment with that of other sectors. In several of the countries/territories, in the more general surveys (e.g. census, household income and expenditure survey [HIES]), fisheries-related employment data are often reported in a lumped category that includes agriculture and forestry. This practice of lumping the data makes it difficult to identify fishery employment trends over time and to make comparisons of fishery employment across countries.
- A third troublesome issue in measuring fisheries employment concerns how formal jobs are counted. A general feature of the information on formal employment related to fisheries of the region is that the definition of the "number of jobs" is vague. In many cases (especially when information is obtained from companies), it is not known whether the "number of jobs" is the total number of people to have worked during a year, the number at a point in time or the number of full-time equivalent (FTE) jobs – or a mixture of the three.

Offshore fisheries employment

| | 2010 | 2015 | 2020 |
|---|---|---|---|
| Cook Islands | 26 | 65 | 88 |
| Fiji | 991 | 3,658 | 3,313 |
| FSM | 373 | 245 | 1,166 |
| Kiribati | 256 | 980 | 961 |
| Marshall Islands | 1,259 | 1,424 | 1,058 |
| Nauru | 5 | 85 | 346 |
| Niue | 0 | 4 | 4 |
| Palau | 42 | 46 | 43 |
| PNG | 7,086 | 9,549 | 13,151 |
| Samoa | 414 | 327 | 339 |
| Solomon Islands | 1,004 | 2,364 | 3,425 |
| Tokelau | 8 | 6 | 7 |
| Tonga | 66 | 142 | 296 |
| Tuvalu | 242 | 185 | 118 |
| Vanuatu | 0 | 0 | 864 |
| Total | **11,772** | **19,080** | **25,180** |

# Fish consumption




Ranges in estimates of annual per capita fish consumption (kg/person/year)

## Some observations on the above graph

- There have been few new fish consumption studies since that given in the 2016 Benefish study.
- The range in per capita consumption in the above graph can come from a change in the national per capita fish consumption rate over time, or from the methodology used to make the estimate (or both).
- In general, the countries that are made up mostly of atolls (Kiribati, Tuvalu and FSM) have the highest fish consumption rates.
- The countries that have the lowest fish consumption rates are those that either have large inland populations (PNG and Vanuatu) or are relatively affluent.
- Several of the countries that have moderately high fish consumption (FSM, Palau and Samoa) had locally based longline fleets during the period of the consumption studies.
- The countries with very high consumption rates also have very large ranges in the rates.

## Increase in consumption of pelagic fish

Some of the ways in which greater use of pelagic fishery resources is occurring are:

- The sale of longline bycatch and non-export grade tuna at longline bases in the region.

- The leakage and sale of fish from purse seine transshipment. Tolvanen et al. (2019) estimate that in the region, transshipment is responsible for putting ashore 1,818 t of pelagic fish annually.
- Canned tuna sold in regional markets: this has been estimated to be 2,600 t (Fiji), 3,000 t (Solomon Islands) and 3,300 t (PNG).
- Government initiatives in some countries to increase consumption of pelagic fish. As an example, the Ministry of Fisheries in Tonga has an initiative geared to increasing the consumption of tuna; foreign fishing vessels are required to offload 3.5 t of tuna for the project in high peak seasons and 2.5 t in low peak seasons.

## The impacts of Covid on fisheries

Although Covid affected the fisheries in each PICT in different ways, the general impact of Covid on fisheries in many PICTs was depressed coastal commercial production and moderately elevated coastal subsistence production. For the offshore fishery operations, it appears that the impacts were greatest in 2020, and by 2021 many (but not all) of those impacts were mitigated. Other common features of the impact of Covid on fisheries are:

- The effects of Covid on fisheries were largest in places dependent on tourism and places dependent on airfreighting fishery products to markets.
- The fisheries effects were smallest in isolated places where fisheries are oriented to local consumption.
- The types of aquaculture most affected by Covid were those operations involving international trade. On the input side, this involves supplies of fry and feed. On the output side, this involves overseas markets such as that for cultured aquarium products, pearls and shrimp.
- Many PICTs had other shocks that occurred about the same time as Covid, and it was difficult to disentangle the impacts of Covid from the impacts of those shocks. This included a large dengue outbreak in the Marshall Islands, the volcanic eruption in Tonga, cyclones in Vanuatu and Fiji, the opening of the beche-de-mer fishery in Fiji, and the declaration of a large pelagic marine protected area (MPA) in Palau.

### The impacts of climate change on fisheries

During the study, in the interviews conducted with fisheries specialists (primarily senior officials of government fisheries agencies), the impacts of climate change on fisheries were explored. The discussions were focused on what impacts have occurred in their countries, rather than predictions of what may happen in the future. From the interviews several features emerged:

- Coral bleaching is more common now than in the past.
- The tuna that are the target of the purse seine fishery will move to the east (according to SPC scientists) – but there is a lack of hard data to show that this has happened yet.
- Climate change has definitely impacted marine habitats, but it is not certain how those impacts affect fisheries.
- Any change of fish abundance by climate change is overshadowed by the overexploitation of those fish.

## Recommendations for improving the measurement of fisheries benefits

Recommendations for improving the measurement of the main categories of fisheries benefits are discussed in several sections of this book. The main recommendations for improvement are given in a table in the recommendations section. They consist of ways to improve measurement of fisheries production (5 recommendations), measurement of fishing contribution to GDP (6), and measurement of exports (4), government revenue (2), employment (9) and fish consumption (5).

### Higher-level and longer-term recommendations

In the above list there is a large number of (mainly technical) recommendations to improve the measurement of benefits from fisheries. Below, the focus is on institutional and policy changes:

- Because many of the suggestions involve enhanced interaction between fisheries agencies and statistics agencies, a general priority arising from the present study is that mechanisms should be explored on how to encourage the desired cooperation between fishery agencies and statistics offices.

- The remarkable drop of per capita production from coastal fisheries over the period 2007–2021 alone (a decrease of 14% over 21 years) should be a "wake-up call" for countries that do not focus much attention on effective coastal fisheries management. Because it is coastal fisheries that provide most of the fisheries-related employment and food in the region, implementing the difficult task of improving coastal fisheries management should be pursued with greater vigour.
- The paucity of information on coastal fisheries production is a problem in most countries of the region. If a fisheries agency cannot afford some type of snapshot coastal fisheries survey, consideration should be given to obtaining information from studies outside the fisheries sector – a HIES, agriculture census or national census – but again, the key to assure relevance of those surveys to fisheries is cooperation with statistics offices.
- In the past, one of the most important tools for learning what was happening in a national fisheries sector was the annual report of the government fisheries agency. These reports provided information useful not only for regional fishery researchers, but also for national fishery stakeholders, other government agencies, the media and the general public. There should be additional assistance by regional organisations and other development partners to those countries who wish to improve their annual reports.
- Access fees for offshore fishing expanded greatly between 2007 and 2023. It is obvious that increases in regional tuna catches taken over the last six decades, and the associated increases in access fees, cannot continue forever. Efforts to diversify the benefits from offshore fisheries, including the areas of GDP (i.e. local basing), exports, employment and food, should receive increased attention, similar to past efforts to expand catches and increase access fees.
- In terms of the supply of fish for consumption in the region, a number of studies (including the present report) point to a decline in availability from traditional sources (i.e. coastal fisheries). Several mechanisms to mitigate this decline have been pursued over the years (e.g. aquaculture, fish aggregating device [FAD] fishing and diversion of fish from offshore fishing) with varying degrees of success. Considering the gravity of the fish shortage problem and how many resources have been invested in attempting to alleviate the situation, there should be an evaluation of the effectiveness of those mechanisms.

# 2 Background

The importance of fisheries to the economies of Pacific Island countries and territories (PICTs) cannot be understated, yet this importance has been poorly documented. In 2008 and 2016 the Pacific Community (SPC) cooperated with the Forum Fisheries Agency (FFA) and other organisations to produce two editions of the book "Fisheries in the Economies of Pacific Island Countries and Territories" (informally known as the "Benefish studies"). The publications brought together much of the available information on the benefits from fisheries in terms of total fish harvests and contributions of fishing and aquaculture to gross domestic product (GDP), exports, government revenue, employment and nutrition. The overall objective of that work was to raise the profile of fisheries and aquaculture by identifying the various types of benefits that each PICT receives from fisheries. These studies compiled and generated data that are now used to benchmark the importance of fisheries across the Pacific. Many fisheries officers in the Pacific Island region have found the publications useful for stressing the point with their governments that fisheries and aquaculture are in fact more important than commonly assumed.

However, over six years have passed since the last publication. In that period, a number of significant events have occurred, including the COVID-19 pandemic, the collapse of the tourism sector, which dramatically reduced domestic demand for more high-end seafood products, and increases in coastal subsistence fishing and the costs of inputs to fishing. An updated Benefish study was needed to understand changes to the level of benefits from fisheries and aquaculture, and to set new baselines against which management and development projects can be measured.

This work is in line with requests from Pacific Island government officials and ministers. The 14th Heads of Fisheries Meeting (June 2022) requested that the Fisheries, Aquaculture and Marine Ecosystems (FAME) division of SPC continue to support the collection and pooling of coastal fisheries data to improve data-limited fisheries and coastal ecosystem management (Outcome 10b.i). The 3rd Regional Fisheries Ministers Meeting (August 2022) identified the significant socioeconomic value and economic potential of aquaculture that remains underdeveloped (Outcome 8). The Ministers also endorsed the development of improved indicators for future Coastal Fisheries Report Cards, and this study will contribute data to the next Report Card (Outcome 15).

SPC considered an update of the Benefish study significantly important and urgent that core funding was allocated so that FAME could deliver the project to meet member needs. SPC was also able to utilise some FAME Australian Programme funding to ensure the project could be completed in a timely manner.

# 3 Study Considerations and Definitions

## 3.1 This study

This volume covers many of the same topics as the three earlier Benefish studies (Gillett and Lightfoot 2001; Gillett 2009a; Gillett 2016). For the convenience of the target audience, this book does not need to be read in conjunction with the earlier editions – key conclusions and recommendations from the earlier studies appear in Appendix 1, and many of the explanations and observations that remain valid have been incorporated into the text of the present study.

One of the principles in producing this fourth edition of the Benefish study of fisheries in Pacific Island countries and territories was that, as much as possible, the categories of data and methodology should remain consistent throughout the series of Benefish books to enable comparison between the studies.

In addition to the topics covered in the 2016 Benefish report, this study also includes:

a) The impacts of the COVID-19 pandemic and climate change on fisheries contribution to economies where there are data available on impacts, changes or trends.

b) Recommendations on data that PICTs should collect in the future, and how it might be reported on to improve the quality of available fisheries information.

The treatment of prices has evolved since the first Benefish study (Gillett and Lightfoot 2001). In this study, except where otherwise noted, fish prices given are those paid to the producer – either dockside prices, prices at first sale or (for aquaculture) farm gate prices. For subsistence fishing, prices are estimated using the farm gate method (see below). Similarly, for offshore fishing, the readily available world market prices for fishery commodities are discounted to cover transport of the commodities to those markets – that is, a pricing system that more closely reflects the in-zone value, which is an important consideration in periods of high fuel costs.

Other aspects of prices given in this book include:

- In most cases, prices for production from offshore fishing are based on those provided in a detailed spreadsheet formulated by FFA each year (e.g. FFA 2022b), with adjustments for the volume and value of bycatch and for the cost of transport to destination markets.[1]

[1] FFA uses "delivered values" (i.e. the value in an Asian port), whereas the present study uses the in-zone value. A crude calculation shows the in-zone value is about 15% less than the delivered value.

- Where information judged to be more accurate than that in FFA (2022b) is available (e.g. data from the American and French territories), the more reliable source is used.
- Unless otherwise stated, all GDP values are expressed in current market prices.
- The valuing of subsistence fisheries production requires some special attention. There are several methods that can be used to assign a monetary value to subsistence production, including: (1) farm gate pricing (used in this book), (2) the value of calories produced, (3) the opportunity cost of labour, and (4) the reservation price of labour. The farm gate pricing method uses the market price of the product less the cost of getting that product to market. In effect, it is indicating that the value of self-consumption is equivalent to the price the product could be sold for in the market, less the cost of getting the product to market. This approach assumes that the volume of subsistence production would have little or no effect on the market price if it were to be marketed. While there are advantages and disadvantages to each of these valuation methods, practical issues determine the best or most appropriate method. In this study, the consultants have used the farm gate pricing method, as recommended by the SPC publication A Guide to Estimating the Value of Household Non-Market Production in the Pacific Island Developing Countries (Bain 1996).

## 3.2 The study area

There is often uncertainty over the geographical area that involves fisheries of the Pacific Island region. The region could be considered as large as the area bounded by the entire western and central Pacific Ocean (WCPO) to the coastal waters of the countries of the region. The "region" encompassed in this and previous Benefish studies consists of 22 PICTs[2] and their associated 200-mile zones. This region can be seen within the wider Western and Central Pacific Fisheries Commission (WCPFC) area in Figure 3-1.

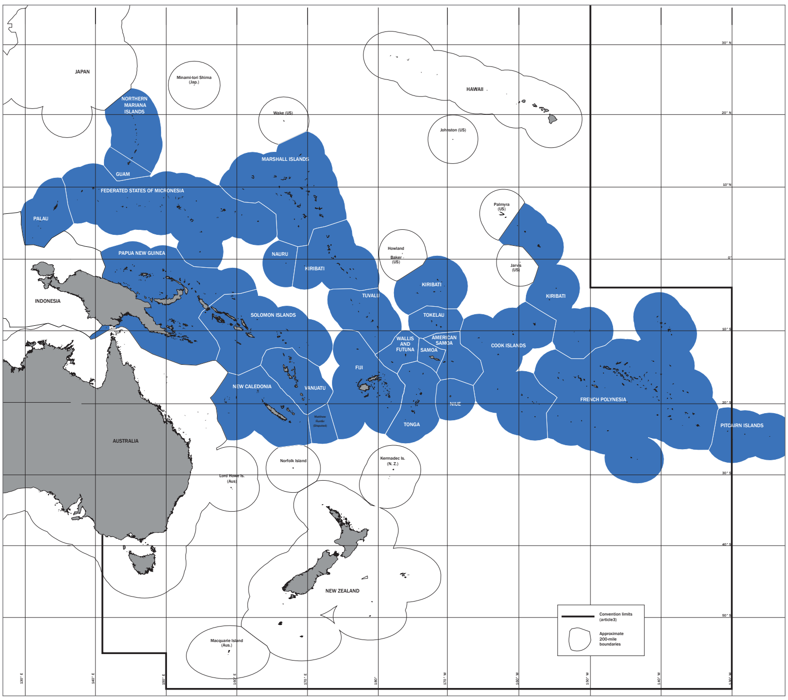



**Figure 3-1:** Pacific Island countries and territories in the area covered by the Western and Central Pacific Fisheries Commission (the whole area is not shown). Source: WCPFC

2 For convenience, the phrase "countries and territories" is often simplified to "countries" in this book.

Summary details of the 200-mile zones and populations of the Pacific Island countries and territories are provided in Table 3-1:

**Table 3-1:** Information on PICT 200-mile zones and population

| | Country/territory | Area of 200-mile zone (km²) | 2007 population | 2014 population | 2021 population |
|---|---|---|---|---|---|
| Independent Pacific Island countries | Cook Islands | 1,830,000 | 15,369 | 15,225 | 15,342 |
| | Federated States of Micronesia | 2,978,000 | 104,754 | 102,908 | 105,754 |
| | Fiji | 1,290,000 | 836,239 | 863,073 | 898,402 |
| | Kiribati | 3,550,000 | 95,470 | 111,117 | 120,740 |
| | Marshall Islands | 2,131,000 | 53,059 | 54,550 | 54,516 |
| | Nauru | 320,000 | 9,373 | 10,660 | 11,832 |
| | Niue | 390,000 | 1,587 | 1,499 | 1,549 |
| | Palau | 629,000 | 20,162 | 17,862 | 17,957 |
| | Papua New Guinea | 3,120,000 | 6,324,106 | 7,570,686 | 9,122,994 |
| | Samoa | 120,000 | 181,267 | 187,372 | 199,853 |
| | Solomon Islands | 1,340,000 | 506,422 | 626,247 | 728,041 |
| | Tonga | 700,000 | 102,248 | 103,347 | 99,532 |
| | Tuvalu | 900,000 | 11,130 | 11,099 | 10,679 |
| | Vanuatu | 680,000 | 227,056 | 271,089 | 301,295 |
| Pacific Island territories | American Samoa | 390,000 | 63,563 | 56,803 | 56,951 |
| | French Polynesia | 5,030,000 | 259,300 | 262,059 | 279,890 |
| | Guam | 218,000 | 172,390 | 179,523 | 178,306 |
| | New Caledonia | 1,740,000 | 239,590 | 262,254 | 273,674 |
| | Northern Mariana Islands | 1,823,000 | 64,109 | 56,338 | 56,801 |
| | Pitcairn Islands | 800,000 | 49 | 49 | 50 |
| | Tokelau | 290,000 | 1,169 | 1,166 | 1,501 |
| | Wallis and Futuna | 300,000 | 13,801 | 12,011 | 11,369 |

Source: SPC/SDD

## 3.4 Definitions

This study organises fish harvests in the Pacific Island region into six production categories. In using a classifying scheme that focuses on the fate of the catch (rather than on the type of fishing), many of the difficulties that arise in classifying fisheries (i.e. the indistinct boundary between subsistence and small-scale commercial fisheries) are avoided. These six categories are as follows:

- Coastal commercial: Catch that is sold (i.e. enters the market) and derives from fishing operations that take place in lagoon, reef, deep-slope or shallow sea areas. This category also includes fish caught by trolling/handlining from small vessels in the open sea adjacent to islands.
- Coastal subsistence: Catch that is retained for consumption by the fisher or given away to family or friends. For simplicity, catches from recreational fishing are considered production for home consumption, and therefore a component of subsistence fisheries.
- Offshore locally based: Catch from industrial-scale tuna fishing operations that: (a) are based at a port in the relevant Pacific Island country, and (b) harvesting is generally carried out more than 12 nautical miles offshore. McCoy (1991) further defines "industrial fishing" as those operations that offload the catch primarily to a fish plant or processing facility.
- Offshore foreign-based: Catch from industrial-scale tuna fishing operations that are based at ports outside of the relevant country.
- Aquaculture: Production from the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding or protection from predators.
- Freshwater: Catch from streams, rivers and lakes, whether for subsistence or commercial purposes.

Some additional terminology clarifications are required:

- In this study "fishing" is considered the harvesting of aquatic animals and plants and includes aquaculture unless otherwise stated.
- Similarly, "fisheries" is considered an inclusive term and includes aquaculture and post-harvest activities.
- The terms "catch", "production" and "harvest" are considered equivalent.
- For GDP purposes, the economic sector is "fishing" rather than the more inclusive "fisheries" (Section 4.2 below). In this book, the term "fisheries sector" includes the "fishing sector" plus post-harvest activities.

- "Fish" is defined (as in the legislation of most Pacific Island countries and territories) as aquatic living organisms and in this study, the term includes invertebrates and plants. The term "finfish" is used to emphasise the narrower definition of fish.
- The phrase "information not readily available" is used often in this book. It is intended to convey the concept that the information may be available somewhere, but that a substantial amount of intense searching for several days in-country and opportunistically over a period of several months (i.e. as was done to collect information for this book) has not resulted in locating the information. In several cases, the term is used euphemistically for a situation in which a civil servant may have promised to send information but failed to do so.
- For convenience, "countries and territories" is often simplified to "countries" in this book.

The term "access fees" is used in this book as revenue obtained by a government for offshore fishing activity from either foreign-based or locally based vessels. Fishing activity that results in access fees was originally confined to that government's waters. However, since the introduction of the purse seine vessel day scheme (VDS), revenue is also obtained by governments from selling vessel days, sometimes resulting in a government earning money from fishing in another country's waters.

# 4 National Accounts, GDP and Fishing

## 4.1 National accounting

National accounts refer to the accounting framework used to measure the current economic activity in a country. Most countries in the Pacific region publish national accounts. The method used in each country is generally based on the standardised System of National Accounts (SNA) originally introduced by the United Nations in 1953. The SNA has since been revised and refined and was republished most recently in 2009.[1]

Governments, international agencies and private corporations typically use national accounts to monitor developments within an economy. In particular, national accounts are used to:

- Monitor changes in economic activity.
- Make cross-country comparisons.
- Prepare time series analysis.
- Identify functional relationships.
- Determine aid eligibility and requirements.

In practice, while the methods used to construct national accounts are based upon a standardised system, different approaches may be used, and the quality of the data available can vary significantly. There may be substantial differences in the methods used by each country, so care should be exercised when making country comparisons. In several cases, the methods used within a country have changed between the various Benefish studies; hence, intertemporal comparisons for those countries should also be approached with caution.

While national accounts provide several measures of activity, the two indicators that are most commonly quoted are GDP and gross national income (GNI).[2] GDP measures the level of domestic economic activity, i.e. the economic activity that took place within a country during a specified period of time. GNI is the measure of national economic activity and includes domestic activity (GDP) plus the net return to the country from overseas investments and remittances. In the case of fishing, these returns from overseas include income from fishing access fees for non-resident fishing by foreign operators. This income is classified as "rental income".

[1] A more comprehensive description of national accounting can be found in most macroeconomic textbooks. The supporting documentation to the System of National Accounts 2008 provides a comprehensive description of the procedures and conventions used in preparing national accounts.

[2] Prior to the 1993 revision of the System of National Accounts, gross national income was known as gross national product (GNP).

The three different approaches for computing the national accounts of a country are the production approach, income approach and expenditure approach.

- The production approach views the economy from the perspective of production. This approach measures the gross output of each producer then deducts the value of the goods and services purchased from other producers and used in the production process.
- The income approach measures the major components of value added: employee compensation (wages and other remuneration), operating surplus (company profits) and indirect taxes net of subsidies. The sum of these components is the value added to GDP.
- The expenditure approach is based on the final use of the output produced. It sums the expenditures of the main participants in the economy: government final consumption, private final consumption, gross capital formation and net exports.

Given that all three approaches are derived from the same data, by definition, the GDP calculated by each should be identical. In practice, it is often difficult to measure all elements within a country's national accounts with equal reliability. Accordingly, there may be differences between the results generated by each approach. However, these differences are seldom significant.

## 4.2 Important considerations for the fishing sector

Gillett and Lightfoot (2001) discuss aspects of the SNA that are especially important to the fishing sector in considerable detail. Because that discussion is relevant to the present study, it is provided as Appendix 1 in this book.

Several points in the appended Gillett/Lightfoot discussion deserve emphasis, as follows:

> Fishing vs fisheries: According to the SNA, the sector is "fishing" rather than the more inclusive "fisheries". Post-harvest activities such as fish processing are not included in the fishing sector but are generally counted in manufacturing and other sectors. Both aquaculture and subsistence fishing are considered by the SNA to be components of the fishing sector. Unless otherwise stated in this volume, this study follows the SNA convention and for GDP purposes, the sector is "fishing" and does not include any post-harvest activities.
>
> **Residency:** The nature and extent of residency is a core SNA concept and defines what is counted as a domestic product. For goods and services to be included in the GDP of a particular country, a resident of that country must produce them. A resident is an individual or

enterprise whose "centre of economic interest" is within the country. The residency concept is especially important in the several Pacific Island countries that have locally based foreign fishing vessels.

**Weaknesses of the concept of GDP:** GDP is an estimate of economic activity and is seldom a precise calculation. Even though the SNA sets out fairly straightforward procedures, in practice the analyst is usually confronted with many uncertainties. Another difficulty is that GDP is an imperfect indicator of the flow of economic benefits from economic activity. This can be quite important in countries where, according to the SNA, locally based foreign fishing is part of the local economy, but a significant proportion of the profits are remitted overseas. The net effect of fishing on economic activity – the "multiplier effect" – can give more information than GDP contribution, but in practice it can be difficult to calculate.

**Small GDP contribution:** Although a sector's contribution to national GDP may seem small, it can be crucially important to the national economy. The country of Iceland is a good example. The fishing industry is one of the key industries in Iceland and directly employs around 7,500 people, approximately 3.9% of the total workforce. The exports of marine products in 2020 accounted for 40% of the value of exported goods of the country, but fishing contributed only 8.1% to GDP directly.[3] This is because many fishing-related activities are accounted for in other sectors, such as manufacturing, and much economic activity generated by fishing is attributed to other sectors, such as retail trade. From this perspective, the fishing contribution to Kiribati's GDP estimated by the present study (15.6%) can be better appreciated.

Appendix 3 contains guidelines for calculating the fishing contribution to GDP. The guidelines include overall considerations, general information on value-added ratios (VARs), VARs determined from 22 fishery studies in the Pacific Island region, and the VARs used in this book for 14 categories of fisheries and aquaculture.

[3] Data from OECD.

# 5 Country/Territory Specific Information on Benefits from Fisheries

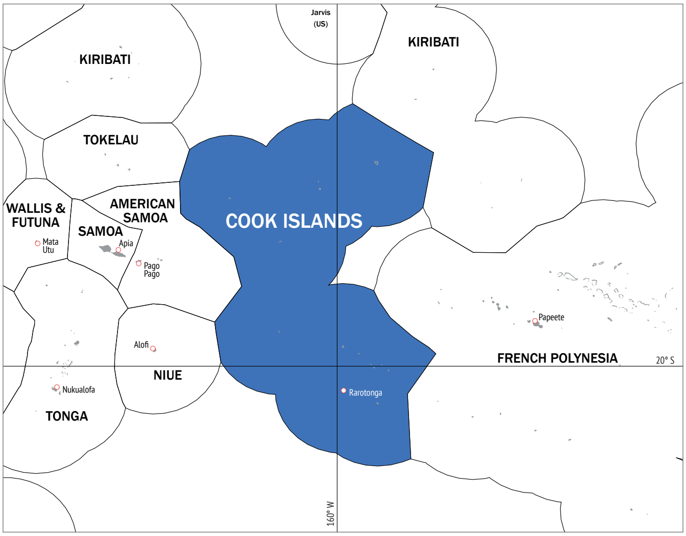
In the following 22 country and territory chapters, information on benefits from fisheries is provided for each Pacific Island country and territory. Each country chapter contains the most recent and readily available data in the following areas:

- Annual fishery harvests: values and volumes for the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing and (6) aquaculture.
- Fishing contribution to GDP: the current fishing contribution, how it was calculated, and a production approach re-calculation based on annual harvest levels obtained during the study.
- Fishery exports: amounts, types and the ratio to all exports.
- Government revenue from the fisheries sector: access fees and other revenue.
- Fisheries-related employment.
- Fisheries contribution to nutrition.

The information presented generally covers the period since the third Benefish study (Gillett 2016), although in some cases, no new data have emerged in the last decade. New data are most often lacking in the areas of employment and nutrition.

For most of the areas above, the country and territory chapters simply cite and summarise the findings from existing studies. However, for all countries, determining the volumes/values of recent annual fisheries harvests in the six production categories, considerable analysis and (in some cases) speculation was required.

# 6 Cook Islands




## 6.1 Volumes and values of fish harvests in Cook Islands

### Coastal commercial catches in Cook Islands

The following describe the major historical attempts to consolidate information about coastal fisheries production in the Cook Islands:

- Dalzell et al. (1996) used data sources from the late 1980s and early 1990s to estimate subsistence fisheries production of 858 tonnes (t)[1], worth US$3,047,683, and commercial coastal fisheries production of 124 t, worth US$314,761.
- Senior officials of the Ministry of Marine Resources (MMR) estimated the production for 2000 as follows: pearls, NZ$18,400,000; small-scale commercial fishing (food fish 80 t, NZ$650,000; aquarium fish NZ$252,000; and trochus NZ$200,000); and subsistence production, 795 t.
- MMR (2001) estimated the value of subsistence fisheries to be NZ$2 million annually.
- Gillett and Lightfoot (2001) considered the above studies and estimated production of 80 t for coastal commercial fishing and pearl farming

[1] Note: 1 tonne = 1 metric ton = 1,000 kg

(worth NZ$19.5 million), and coastal subsistence production of 795 t (worth NZ$2.2 million).

- Gillett (2009a) made catch estimates for all Pacific Island countries and territories, including the Cook Islands. That study considered the previous estimates, described above, as well as additional information from a study on the situation and outlook for marine resources in the Cook Islands (MMR 2008b), and from the Cook Islands household income and expenditure survey (HIES) that was carried out in 2005/06 (Statistics Office 2007).
- The situation and outlook study (MMR 2008b) reported that the catch from the Cook Islands fish aggregating device (FAD) fishery by subsistence and semi-commercial fishers had oscillated in recent years between 20 and 50 t of fish annually. In 2007 the catch was estimated at 49.3 t. The average price on the domestic market is estimated to be around NZ$8 per kilogram of whole fish. Assuming that one third of the 49.3-t catch was sold and applying farm gate pricing to subsistence catches, the production can be estimated as 16.41 t for commercial (worth NZ$131,280) and 32.8 t for subsistence (worth NZ$183,680).
- The 2005/06 Cook Islands HIES showed that with respect to fishery products, there was a total expenditure of NZ$5,091,700 on "fish including shellfish". Unpublished data supplied by the Statistics and Demography Programme of the Pacific Community (SPC) provides considerable information on coastal commercial and subsistence production. The HIES (with adjustment for offshore fishing, aquarium fish and any trochus harvested) suggests that in the period 2005 to 2006, commercial fisheries production was 139 t, and subsistence production was 239 t.
- The Gillett (2009a) study considered the HIES results, the situation and outlook report (MMR 2008b) and some recent developments affecting coastal fisheries (population changes, ciguatera fish poisoning, and reduced air and sea transport to the northern islands). The study concluded that the production from coastal commercial fisheries in the Cook Islands in the mid-2000s was about 133 t (worth about NZ$1.4 million to fishers) and about 267 t (NZ$1.7 million) from coastal subsistence fisheries. Relative to the estimates of coastal fisheries production in other Pacific Island countries, the study's assessment for the Cook Islands is thought to be reasonably accurate.
- Gillett (2016) examined some external factors that could affect coastal fisheries production in the country: population changes, reduction in the number of public servants in 2008/09, an expansion of the FAD programme, a relaxation of tridacna export bans, annual trochus

harvest, reduction in flights to the northern islands, and amounts of exported fishery products. The study estimated the production from coastal commercial fisheries in 2014 was around 150 t, worth approximately NZ$1.7 million to fishers.

From 2014 to 2021, fishery stakeholders in the Cook Islands reported no major shocks to fisheries until the period when Covid set in. Tourism (and the associated tourist demand for fish) vanished with the border closure in March 2020. Although people in the Cook Islands did not start to get sick until 2021, many people in Rarotonga and Aitutaki lost tourism-related jobs in mid-2020 and looked to fishing for work and food, increasing fishing pressure around those islands. Fish production increased and the price of fish dropped, which led to the general public adding more fish to their diet. The northern islands were cut off from Rarotonga and the north/south fish trade stopped. The negative impacts from job losses were partially mitigated by government subsidies.

Other changes in the 2014–2021 period that could have conceivably affected coastal fisheries production were:

- Tourist arrivals rose steadily during the period, reaching about 130,000 per year in 2019 before crashing during Covid (MFEM 2020).
- According to MMR staff, there was an increase in deep reef slope fishing.
- There was also an increase in reef gleaning for shellfish (K. Passfield, per. com. February 2023)
- Over the period 2009–2016, the average annual export value of aquarium products was NZ$107,000. No aquarium exports occurred in 2017–2019 (Gillett et al. 2020).
- The most recent trochus harvest was in 2015, with values at NZ$86,000 (MMR 2020).
- MMR continued to have one of the best organised FAD programmes of any Pacific Island country.
- The population of the country declined by 5.5% (SPC/Statistics for Development Division [SDD] data).
- Catch by small-scale trolling for tuna declined considerably in 2021 (Table 6-1).

**Table 6-1:** Small-scale trolling for tuna in the waters of the Cook Islands

| | Effort | Albacore | Bigeye | Yellowfin | Skipjack | Other | Total |
|---|---|---|---|---|---|---|---|
| 2017 | 17,302 hrs | 0 | 0 | 92 | 4 | 4 | **100** |
| 2018 | 17,651 hrs | 1 | 1 | 87 | 5 | 3 | **97** |
| 2019 | 13,642 hrs | 3 | 1 | 64 | 7 | 2 | **77** |
| 2020 | 10,890 hrs | 0 | 0 | 69 | 5 | 4 | **78** |
| 2021 | 13,295 hrs | 0 | 0 | 44 | 3 | 1 | **48** |

Source: MMR (2022); Units: tonnes

In their valuation of ecosystem services in the Cook Islands, Brander et al. (2020) provide the values of subsistence fisheries, commercial fisheries, trochus, pearls and others (e.g. tourism, recreation). The report strives to estimate the "total economic value" of an ecosystem service, which includes all of the net benefits humans receive from that ecosystem service. This study is not independent of the series of Benefish studies as it contains the statement, "The results from Gillett (2016) are used to value subsistence and commercial fisheries in this report". However, both the method of valuation and composition of categories differ between the studies, as do the focus years (2014 vs 2019). The ecosystem services study concludes that the economic value of subsistence fisheries is worth NZ$3,661,82 per year, commercial fisheries NZ$50,389,917, trochus NZ$55,690, and pearls NZ$300,000.

According to MMR staff and other fishery stakeholders, fish prices in 2022 were: tuna, NZ$15–$40 per kg[2]; flying fish, $12; reef fish, $20; and parrotfish, $15. Prices were lower in 2021 due to Covid.

It is difficult to use the above information to adjust the Gillett (2016) estimate of coastal commercial fisheries production to make an educated guess of the 2021 production. Nevertheless, a crude approximation of the 2021 production would be 150 t, worth approximately NZ$1.6 million to fishers.

## Coastal subsistence catches

Anecdotal information suggests that coastal subsistence fishing in the Cook Islands has been declining gradually over the past few decades, but for reasons advanced in the section above, it is likely there was an increase in subsistence fishing during the Covid period. An educated guess at the coastal subsistence production in 2021 would be about 280 t, worth NZ$2.3 million to fishers.

[2] The upper end of this range is probably for tuna loins.

## Locally based offshore catches

The paper prepared by the MMR for the 2022 meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission reports that in 2021 the Cook Islands national fleet consisted of 11 longline vessels, seven bunker vessels and one purse seine vessel operating within the Western and Central Pacific Fisheries Convention Area. Almost all of those vessels were based in Suva, Pago Pago and Apia. There was only one small locally based longline vessel operating out of Rarotonga in 2021 (MMR 2022).

The catch of the single locally based vessel (about 100 t) can be estimated from older catch records (Brown 2015). The value of the catch (NZ$25 per kg for both tuna and bycatch) is from staff of MMR's Offshore Fisheries Division (A. Jones, per. com. December 2022).

The 2021 locally based offshore catch is estimated to be 100 t, worth NZ$2.5 million.

## Foreign-based offshore catches

MMR (2022) states that a total of 61 foreign-flagged vessels were licensed and authorised to operate within the Cook Islands exclusive economic zone (EEZ) during 2021: 51 longliners and 10 purse seiners. Foreign-flagged fishing in 2021 was undertaken by six Chinese longline companies, one Spanish purse seine company, one Kiribati, one Ecuadorean and one New Zealand company.

**Table 6-2:** Foreign-based offshore catches in the waters of the Cook Islands (t)

| Gear | Effort | ALB | BET | YFT | SKJ | Other | Total |
|---|---|---|---|---|---|---|---|
| Longline | 98,248 hooks | 1106 | 183 | 631 | 27 | 215 | 2,162 |
| Purse seine | 92 days | 0 | 146 | 292 | 2019 | 2 | 2,459 |

Using price information from the Forum Fisheries Agency (FFA 2022a) and adjusting for in-zone prices (FFA gives delivered prices), the value to fishers of the 4,621 t can be determined. The catch is worth NZ$15.7 million.

## Freshwater catches

Based on limited data, the national annual freshwater catch is estimated to be 5 t for the purposes of the present study. As almost all of the freshwater catch is for subsistence purposes, a value is assigned on a similar basis as the coastal subsistence section above. The catch is worth NZ$41,000.

## Aquaculture harvests

In the Cook Islands, the most significant type of aquaculture presently is pearl farming. Kinch et al. (2020) reviewed the history of pearl farming in Manihiki (Box 6-1).

**Box 6-1:** The recent history of pearl farming in Manihiki

The total number of cultured pearl shell increased from 520,000 oysters in 1991 to 880,000 oysters in 1996 and continued to increase and then dropped off drastically in the 2000s. In 1996 there were 164 pearl farms recorded in the Manihiki lagoon covering an area of 9 $km^2$ with about 3.5 million pearl shell spat on collector lines. A later survey in 1999 reported 111 pearl farms operating in the Manihiki lagoon, with a total of 690 lines holding culture pearl shell and 424 of collection lines holding 1.5 million. The total length of these pearl farm lines was estimated to be 160 km in length covering an area of 7.7 $km^2$. The reduction in pearl farms from 1996 to 1999 is attributed to the impact of Cyclone Martin in 1997. In 2014 it was estimated that there were 460,000 pearl shell spat and 480,000 cultured pearl shell distributed throughout 126 farms. Of these 126 farms, 13 were found to be empty, 65 failed to be in compliance with the newly formulated Manihiki Lagoon Management Plan, with only 48 being in compliance. The largest issues involving noncompliance were sunken lines and line spacing. The total space available for pearl farming in the Manihiki lagoon in 2014 where depths are between 10 to 30 m was estimated to be around 2,530 hectares. Of that area, the permitted pearl farms cover 1,272 hectares, or approximately 50% of the available space with an additional 610 hectares being 'ghost farms'. A survey conducted by MMR in September and October 2019 estimated only 14 real pearl farmers on Manihiki, with around 81,600 cultured pearl shell and 180,300 pearl shell spat under production.

During the present study, discussions concerning aquaculture production were held with a participant in the Cook Islands pearl industry (R. Newnham, per. com. December 2022) and several MMR staff. The information obtained included:

- There are currently three to eight active pearl farms in the Cook Islands.
- The annual pearl harvest in 2021 is estimated to be between 9,000 and 20,000 pearls.
- The average pearl farm gate price is currently NZ$15–$25 dollars per pearl.
- The 2021 annual harvest is estimated to be worth between NZ$262,000 and NZ$332,000.
- According to the Cook Islands Statistics Department, the declared value pearl exports of the country in 2021 was NZ$34,000 [sic].

- Although pearl harvesting took place in 2021, no pearl oysters were seeded that year because the technician who does most or all of the seeding was stuck in Japan due to Covid.
- There is a substantial import into the Cook Islands of pearls from Tahiti. The exact amount is unknown, but the declared pearl imports are taxed at a rate of 100%.
- Other forms of aquaculture in the Cook Islands in recent years include a very small amount of tilapia and some giant clams from the government facility on Aitutaki. In 2021 that facility produced about 67,000 tridacna (3–10 mm), which were used entirely for re-stocking purposes on Aitutaki. The manager of that facility indicated they were worth NZ$0.50 apiece.

For the purposes of the present study, the 2021 production of aquaculture in the Cook Islands will be taken to be 14,500 pearls and 67,000 tridacna, with a farm gate value of NZ$330,500.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values of the fishery and aquaculture harvests in 2021 can be made (Table 6-3).

Table 6-3: Fisheries and aquaculture harvest in the Cook Islands in 2021

| Harvest sector | Volume (t and pcs) | Value (NZ$) |
|---|---|---|
| Coastal commercial | 150 | 1,600,000 |
| Coastal subsistence | 280 | 2,300,000 |
| Offshore locally based | 100 | 2,500,000 |
| Offshore foreign-based | 4,621 | 15,700,000 |
| Freshwater | 5 | 41,000 |
| Aquaculture | 81,500 pcs | 330,500 |
| Total | 5,156 t and 81,500 pcs | 22,471,500 |

Figures 6-1 and 6-2 show the volumes and values of the 2021 Cook Islands fisheries production. Aquaculture is not shown in the volumes figure due to the use of mixed units (pieces and tonnes).

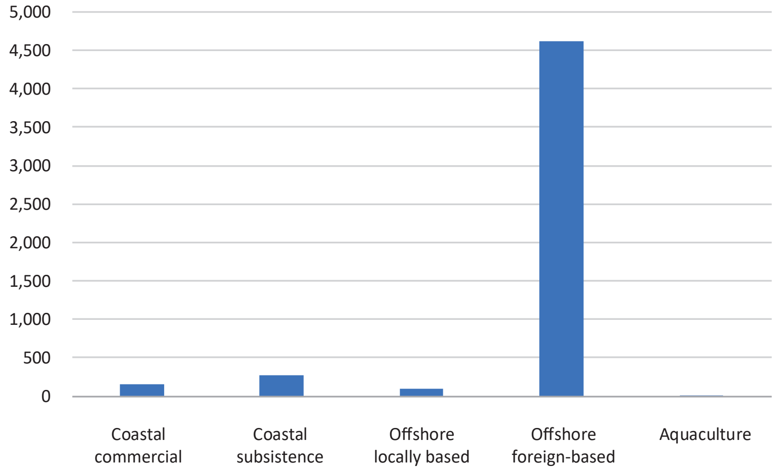



**Figure 6-1:** Cook Islands fisheries production in 2021 by volume (t)

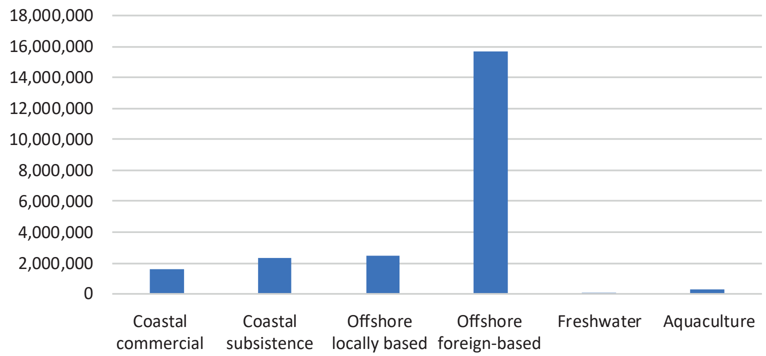



**Figure 6-2:** Cook Islands fisheries production in 2021 by value (NZ$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The estimated fishery production levels for the Cook Islands from those three studies are presented in Table 6-4.[3]

[3] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or Pacific non-independent territories.

Table 6-4: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Value (NZ$) |
|---|---|---|---|
| Coastal commercial | 1999 | 80 | 19,500,000 |
| | 2007 | 133 | 1,400,000 |
| | 2014 | 150 | 1,700,000 |
| | 2021 | 150 | 1,600,000 |
| Coastal subsistence | 1999 | 795 | 2,200,000 |
| | 2007 | 267 | 1,700,000 |
| | 2014 | 276 | 2,000,000 |
| | 2021 | 280 | 2,300,000 |
| Offshore locally based | 1999 | 75 | 750,000 |
| | 2007 | 3,939 | 7,850,000 |
| | 2014 | 194 | 2,900,000 |
| | 2021 | 100 | 2,500,000 |
| Offshore foreign-based | 1999 | 300 | 770,000 |
| | 2007 | 0 | 0 |
| | 2014 | 20,342 | 73,156,933 |
| | 2021 | 4,621 | 15,700,000 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 5 | 50,000 |
| | 2014 | 5 | 37,500 |
| | 2021 | 5 | 41,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 3 t and 190,000 pcs | 3,040,000 |
| | 2014 | 12 t and 52,000 pcs | 1,095,000 |
| | 2021 | 81,500 pcs | 330,500 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for coastal commercial, coastal subsistence and freshwater change significantly between the years, but most of that change is due to the way in which the production was estimated. For example, the drop in production of coastal subsistence fisheries between 2001 and 2007 is due to better information becoming available (i.e. the 2006

Cook Islands HIES), rather than a decrease in the amount of fish being harvested. In contrast, changes in production figures in the table for offshore fisheries and aquaculture (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 6.2 Contribution of fishing to GDP

### Current official contribution

The Statistics Office of the Ministry of Finance and Economic Management refers to the fishing sector as "fishing and pearls". The official contribution of this sector to GDP is given in Table 6-5.

**Table 6-5:** The fishing contribution to GDP (NZ$ millions)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Fishing (including pearls) | 1.5 | 1.6 | 2.3 | 1.2 | 2.0 |
| GDP at market prices | 486.4 | 524.2 | 575.4 | 437.0 | 463.3 |
| Fishing as a % of GDP | 0.3% | 0.3% | 0.4% | 0.3% | 0.4% |

Source: Cook Islands Statistics Office (unpublished data)

### Method used to calculate the fishing contribution to GDP

In a general sense, the Cook Islands Statistics Office uses the production approach to calculate the Cook Islands GDP. This approach measures the total value of goods produced in the Cook Islands after deducting the cost of goods and services used in the production process. Generally, the GDP in this approach is calculated as the total gross output (GO) less intermediate consumption (IC).

Staff of the Cook Islands Statistics Office provided a table showing the value added of the various fishing sub-sectors (Table 6-6), enabling insight into the methodology.

**Table 6-6:** The value-added components of the fishing sector

| | 2021 |
|---|---|
| Subsistence fishing | $832,211.24 |
| Commercial fishing | $1,065,509.28 |
| Unincorporated fishing | $13,684.58 |
| Pearls | $48,473.13 |
| **Total fishing incl. pearls** | **$1,959,878.23** |

## Alternative estimate of fishing contribution to GDP

Table 6-7 (below) represents an alternative to the official method of estimating fishing contribution to GDP in the Cook Islands. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were calculated in Section 6.1 above (summarised in Table 6-3) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 6-7 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information on the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

**Table 6-7:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (NZ$, from Table 6-3) | VAR | Value added (NZ$) |
|---|---|---|---|
| Coastal commercial | 1,600,000 | 0.65 | 1,040,000 |
| Coastal subsistence | 2,300,000 | 0.80 | 1,840,000 |
| Offshore locally based | 2,500,000 | 0.20 | 500,000 |
| Freshwater | 41,000 | 0.90 | 36,900 |
| Aquaculture | 330,500 | 0.45 | 148,725 |
| Total (NZ$) | **6,771,500** | --- | **3,565,625** |

Source: Production section of this chapter and Appendix 3

The NZ$3.6 million value added from the fishing sector represents 0.8% of the Cook Islands' GDP of NZ$463.3 million in 2021.

The fishing contribution calculated using the alternative method (NZ$3.6 million) is much greater than the official contribution of NZ$2.0 million given in Table 6-6 above. In comparing Table 6-7, immediately above, with Table 6-6 in the section on the method used to calculate the official fishing contribution, it is evident that:

- The value added for subsistence fishing in the alternative estimate is much greater than that in the official GDP.
- The value added for aquaculture in the alternative estimate is much greater than pearls in the official GDP.
- The combined value added of coastal commercial fishing and offshore locally based fishing is much greater than the combined value added of commercial fishing and unincorporated fishing in the official GDP.

## 6.3 Exports of fishery production

Data on fishery exports of the Cook Islands were kindly provided by staff of Cook Islands Statistics Office staff. Those exports are detailed and compared to all exports of the country in Table 6-8.

**Table 6-8:** Fishery exports of the Cook Islands (NZ$ thousands)

| | Live fish | Fresh or chilled fish | Pearls | Pearl shell | Total fisheries exports | Total exports | Fisheries as a % of total exports |
|---|---|---|---|---|---|---|---|
| **2013** | 19 | 12,129 | 142 | 49 | 12,339 | 12,984 | 95.0% |
| **2014** | 91 | 20,350 | 364 | 0 | 20,805 | 21,276 | 97.8% |
| **2015** | 49 | 19,344 | 158 | 167 | 19,718 | 20,162 | 97.8% |
| **2016** | 22 | 18,717 | 297 | 42 | 19,078 | 19,606 | 97.3% |
| **2017** | 0 | 27,268 | 202 | 0 | 27,470 | 28,599 | 96.1% |
| **2018** | 0 | 23,711 | 218 | 1 | 23,930 | 25,209 | 94.9% |
| **2019** | 56 | 20,455 | 174 | 86 | 20,771 | 26,628 | 78.0% |
| **2020** | 0 | 28,874 | 23 | 38 | 28,935 | 29,966 | 96.6% |
| **2021** | 0 | 18,927 | 34 | 0 | 18,961 | 20,779 | 91.3% |

Source: Cook Islands Statistics Office (unpublished data)

Some caveats are required for interpreting the information in Table 6-8 (above). "Live fish" in this table refers to fish in the aquarium trade. "Pearl shell" appears to be "mother of pearl shells", which includes trochus. There is confusion around the "Fish fresh or chilled" category. The exports in this category seem too large in 2021 for the single small locally based longliner. According to MMR (2022), that vessel targets the domestic market. The cited amounts of "Fish fresh or chilled" could include some (but not all) of the catch that is being transshipped by Cook Islands-flagged vessels in ports outside the Cook Islands.

## 6.4 Government revenue from fisheries

### Access fees for offshore fishing

Data on revenue from fisheries were kindly provided by staff of the Cook Islands Statistics Office (Table 6-9).

Table 6-9: Fisheries revenue (NZ$ thousands)

| | 2018/19 Actual | 2019/20 Actual | 2020/21 Actual |
|---|---|---|---|
| Fisheries U.S. Treaty | 5,358.00 | 8,043.00 | 5,888.00 |
| Fishing licenses | 15,164.00 | 5,219.00 | 3,842.00 |
| Fishing fines | 2,263.00 | 238.00 | 836.00 |

Source: Cook Islands Statistics Office (unpublished data)

It is assumed that the categories "Fisheries U.S. Treaty" and "Fishing Licenses" involve payments for access by fishing vessels.

Government revenue in the financial year 2020/21 was NZ$206.2 million (Ministry of Finance and Economic Management website information). The NZ$9.7 million received for "Fisheries U.S. Treaty" and "Fishing Licenses" therefore represents 4.7% of all government revenue.

### Other government revenue from fisheries

As shown in the above table, the Cook Islands received NZ$836,000 as "fishing fines" in the financial year 2020/21.

In some respects, government subsidies to the fisheries sector are the opposite of government revenue from the sector. The only information readily available on fisheries subsidies in the Cook Islands is in the MMR report to the Scientific Committee of the Western and Central Fisheries Commission (MMR 2022), where it is stated:

> Artisanal catch reporting is not regulated; however, in June 2017 the Ministry of Marine Resources (MMR) established a fuel subsidy program as an incentive for fishers to voluntarily submit catch and effort data to MMR. The subsidized fuel is funded under the Sustainable Fisheries Partnership Agreement between the Cook Islands Government and the European Union. This subsidy was a major factor to improving the Cook Islands artisanal data collection programme.

## 6.5 Fisheries-related employment

The Cook Islands 2015/16 HIES (CISO 2018a) contains information about fisheries-related employment:

- 2.7% of all households receive at least some cash for fishing activities.
- 18% of all households participate in fisheries.
- 3% of all households sell a portion of their fisheries harvest.

The Cook Islands Population Census 2016 (CISO 2018b) has fisheries employment data but for much of the detailed information, fisheries is lumped with other sectors to form the category "agricultural, forestry and fishery workers", reducing its utility for fisheries purposes. The census does provide information on household participation in fisheries (Table 6-10).

**Table 6-10:** Number of households engaged in fishing

| | Fishing in lagoon | Fishing outside reef | Fish both inside and outside | Aquaculture | Pearl farming |
|---|---|---|---|---|---|
| Rarotonga | 630 | 194 | 241 | 12 | 12 |
| Southern Islands | 378 | 85 | 246 | 15 | 3 |
| Northern Islands | 93 | 76 | 186 | 5 | 27 |
| Cook Islands | 1,101 | 355 | 673 | 32 | 42 |
| % participation (out of 4,435 total households) | 24.8% | 8.0% | 15.2% | 0.7% | 0.9% |

Source: Modified from CISO (2018b)

In October 2019 SPC conducted a gender assessment of the fisheries sector in the Cook Islands. Box 6-2 provides information on gender roles in Cook Islands fisheries.

**Box 6-2:** Gender roles in fisheries

In the Cook Islands, gleaning is mainly carried out by women, while men target pelagic species in deeper waters. Gleaning is done during low tide and within prescribed confines but generally in shallow water along the inner reef, beaches and lagoon. Women often go in pairs or in small groups to forage for crustaceans, clams, sea cucumbers, urchins, octopus and small fish species. Collective gleaning is also considered an enjoyable activity for some women who use the time for socialising, networking or simply as leisure time. In the outer islands, where a subsistence lifestyle remains strong, more women own or have access to simple paddle canoes that they use to fish in the calm lagoon, reef flats and inside the fringing reef. Compared to men, women use very basic "fishing" equipment, which includes buckets, metal spoons, knives, screw drivers, bamboo sticks or occasionally homemade scoop nets. The lack of female ownership of motorised boats and limited access to such vessels contributes to having a small number of women engaged in pelagic fishing. Women's traditional roles and responsibilities in the home (e.g. child care), or in supplementary income-generating or subsistence activities (e.g. sewing, producing natural oils, handicrafts), and gardening impede their involvement in what is both time- and labour-intensive work. Local customs and traditions continue to play a role in the acceptance of women's engagement in deep-sea fishing, and this can vary from island to island.

Source: Makhoul (2021)

Kinch et al. (2020) give some insight into the labour situation of pearl farming in Manihiki:

> Black pearl farming today on Manihiki is now dependent on family members for labour purposes. Family members work their own farms and any returns are shared out amongst themselves, but usually only for those that work and contribute. Some families engage in reciprocal exchange of labour for larger jobs such as laying lines, harvesting shell for seeding and returning shell after seeding. Women's work in pearl farming is generally land-based. Men do all the diving, setting of lines and placement of platforms. Women assist with drilling, cleaning and stringing shells. Women also usually have the main responsibility of preparing meals to feed those who are working on the pearl farm. Men will also perform this responsibility as well when needed.

## 6.6 Levels of fishery resource consumption

The following are some findings of older studies on fish consumption in Cook Islands:

- Preston (2000) used 1995 Food and Agriculture Organization (FAO) data on production, imports and exports to estimate the annual per capita fish consumption in the Cook Islands to be 63.2 kg.
- Passfield (1997) gives the annual per capita consumption of fish on Tongareva Island as 219.0 kg.
- MMR (2000) states that Cook Islanders consume, on average, 47.0 kg of seafood per person per year.

Tuatai (2001) describes a survey of seafood consumption on Rarotonga. This University of the South Pacific project was intended as a follow-up to a similar survey carried out in 1989. The Tuatai study included finfish, invertebrates and canned fish. The results show a decrease in total seafood consumption over the 1989–2001 period from 317.7 g to 270.7 g per capita per day[4] (representing an annualised decrease from 116.0 kg to 98.8 kg per capita). It is thought that this reduction is due to restrictions placed on fishing activities by marine protected areas (MPAs) and outbreaks of ciguatera fish poisoning.

An investigation was undertaken in September 2006 into the consumption of seafood and meat in Rarotonga (Moore 2006). Ninety households in

[4] Discussions with the author indicate that the per capita consumption was a mixture of whole fish weight equivalent and food weight (T. Tuatai, per. com. October 2008).

Rarotonga were surveyed (with a questionnaire) using a random sampling method. The results were analysed and compared with two previous surveys: a 1989 survey by Dorothy Munroe and the 2001 survey by Teina Tuatai. The results of the 2006 survey indicate a constant decline in average daily per capita consumption rates since 1989, from 318 g in 1989 to 271 g in 2001, and 176 g in 2006[5] (on an annual basis: from 115.9 kg to 98.8 kg to 64.2 kg). Reasons for the decrease in finfish consumption were attributed to many factors, including ciguatera, MPAs, changes in lifestyle, and the high cost of finfish compared to meat products. Where lagoon and reef species were consumed, they were generally received from the outer islands.

Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. Annual per capita fish consumption (whole weight equivalent) for the whole of Cook Islands was 34.9 kg, of which 81% was fresh fish. For rural areas the figure for per capita consumption of fish was 60.9 kg, and for urban areas it was 24.8 kg. Cook Islanders obtain about 35% of their animal protein from fish.

Kronen and Solomona (2008a, 2008b) compared seafood consumption in Rarotonga with consumption on other islands in the country. For Rarotonga, the quantity of fresh fish consumed (kg/capita/year) was 31.66 (±4.62). For Mangaia, the quantity of fresh fish consumed was (kg/capita/year) was 65.71 (±13.39).

Several documents (e.g. Moore 2006, MMR 2008b, MMR 2010) point to a decrease in fish consumption on Rarotonga. A study by Rongo and Van Woesik (2011) proposes that an increase in ciguatera fish poisoning over the past two decades has discouraged local fish consumption. They estimate that 52% of Rarotongans have experienced ciguatera at least once in their lives.

More recently, the Cook Islands 2015/16 HIES (CISO 2018a) contains information relevant to fish consumption. The survey indicates that 5.5% of household expenditure on food is for “fish and seafood”. This is small compared to the 27.0% expenditure on “meat”. In terms of the most important items consumed by households, “fresh/frozen fish” ranks ninth, behind bread/cereals, chicken, canned corned beef, taro, lamb/mutton, eggs, doughnuts and powered milk.

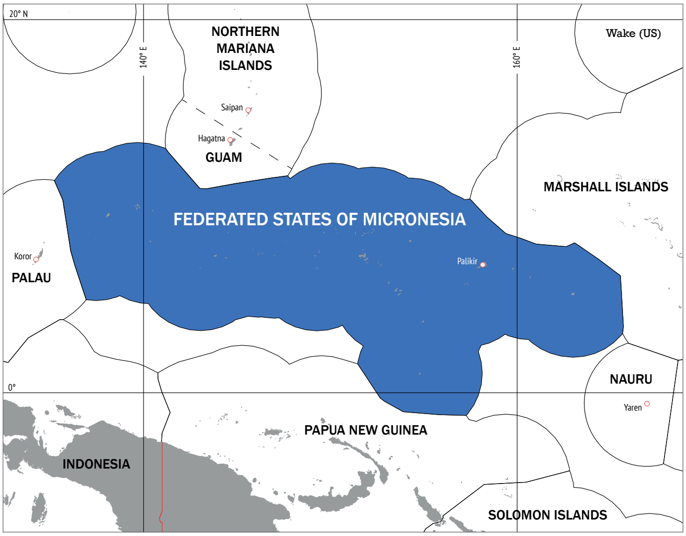
[5] In the text of the report, it is not clear whether the per capita consumption is whole fish weight equivalent or food weight.

## 6.7 Exchange rates

Cook Islands uses the New Zealand dollar (NZ$). The average yearly exchange rates (NZ$ to the US dollar) used in this book are as follows:

| 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|
| 1.47 | 1.44 | 1.42 | 1.48 | 1.50 | 1.40 | 1.47 | 1.74 |

# 7 Federated States of Micronesia




## 7.1 Volumes and values of fish harvests in Federated States of Micronesia

### Coastal commercial catches in Federated States of Micronesia

The following are the major historical attempts to consolidate information on coastal fisheries production in Federated States of Micronesia (FSM) in recent years:

- Smith (1992) reviewed FSM fishery resources for the Forum Fisheries Agency (FFA), concluding that in FSM, "the available information on inshore fisheries production is incomplete and often vague."
- Dalzell et al. (1996) used information from FFA fisheries profiles (Smith 1992) and from a nutritional survey in 1987/88 (Elymore et al. 1989) to estimate coastal commercial fisheries production for the early 1990s of 637 tonnes (t), worth US$1.5 million, and subsistence production of 6,243 t, worth US$11.2 million.
- Gillett and Lightfoot (2001) considered the Dalzell estimate and four other sources of information, and then proposed a coastal commercial fisheries production for the late 1990s of 5,000 t (worth US$14.5 million) and a subsistence production of 5,000 t (worth US$10 million).

- Kronen et al. (2009b) were more conservative in their approach: "Due to the various methods used to estimate inshore fish (especially reef fish) production figures, and the uncertainties associated with the data collection, an estimate of inshore fish production for the whole of FSM is not possible."
- A study of fisheries production in 2008 (Gillett 2009a) examined the above studies and considered other information, including a fisheries survey in Pohnpei covering the period 1998–2008 (Rhodes and Tupper 2007; Rhodes 2008), a follow-up on the Rhodes study (George 2008), the results of the 2005 FSM household income and expenditure survey (HIES), comments and feedback on the Gillett and Lightfoot (2001) estimate, official and non-official export data, and changes in the FSM population structure. The study ventured a very rough estimate for annual coastal commercial fisheries production in FSM for the mid-2000s of about 2,800 t (worth US$7.6 million to fishers) and annual coastal subsistence fisheries production of about 9,800 t (worth US$15.7 million to fishers).
- Gillett (2016) examined about 10 new studies relevant to estimating FSM coastal fisheries production, the new Pacific Community (SPC) "fisheries friendly" 2013/14 HIES for FSM, and export data. This resulted in a 2014 coastal fisheries production estimate of 5,280 t (1,725 t commercial and 3,555 t subsistence), with a value of US$5.0 million for the commercial catch and US$8.8 million for the subsistence catch.

A study funded by the Waitt Foundation (Ladner et al. 2021) summarises the sources of recent data on coastal fisheries in FSM (Table 7-1).

**Table 7-1:** Recent studies on coastal fisheries in FSM

| Data | Year(s) | Spatial resolution(s) | Source |
|---|---|---|---|
| Target species groups, gear type usage frequency, fishing trips per month, percentage of catch sold | 2016 | National, State | Department of Resources and Development, 2019 |
| Participation rate by household, age, gender and wealth group; gear type usage frequency; fishing trips per month and hours per trip; catch by species group; household income and subsistence from fisheries; household consumption and expenditure on fisheries products | 2014 | National, State | Sharp 2017 |
| Coastal catch (subsistence/commercial) volume and value, volume and value of fishery products exports | 2014 | National | Gillett 2016 |
| Gear type usage frequency; catch and revenue per unit effort by gear; average number of fishers and hours per trip by gear; percent of catch, mean length at catch and percent mature at catch by species | 2005, 2016 | State (Pohnpei only) | Rhodes et al. 2018 |
| Total catch volume and value, catch volume by gear, average daily catch by gear, fishing costs by gear, catch per unit effort by gear, percent of catch by species | 2014 | State (Chuuk only) | Cuetos-Bueno et al. 2018 |
| Landings by species (for consumption and sales), fishing location, number of fishers, fishing method/gear, fish length | 2014–2015 | State (Kosrae only) | Houk et al. 2017 |

It is evident from the above table that not much new information on coastal fisheries production has become available since the mid-2010s.

There are several factors and events that could have influenced coastal fisheries production in FSM in recent years. One of the most significant is the overexploitation of coastal resources.

- In the report of an FSM fisheries sector review, Ladner et al. (2021) state that interviews with nearshore fisheries stakeholders suggest that overharvesting of nearshore resources is occurring through various parts of all four states, especially near population centres. Indicators of overfishing include declining catches, loss of spawning aggregations and increasing levels of required fishing effort. These trends have been particularly noted for species important to both subsistence and commercial nearshore fishing activities, including those of high economic value.
- The report of an analysis of FSM's coastal fisheries (IAS 2018) states

there is no doubt that the greatest challenge in coastal fisheries facing the national and state authorities, and indeed the coastal communities throughout FSM, is overfishing and lack of enforcement. Empirical evidence has been collected and shows that overfishing is occurring; fish stocks are declining in many parts of the country, reefs are eroding, ecosystems in some areas are heavily impacted and biodiversity is being lost.

- In a comparative survey of Pohnpei fish marketing between 2006 and 2015 (Rhodes et al. 2018), marketed coral reef fish volumes declined by 50 t per year (about 20%), and the catch-per-unit-effort decreased from 3.4 to 3.2 kg per hour per fisher.

Other factors that could have influenced coastal fisheries production are:

- The Covid period. An assessment of the impacts of Covid on fishing and coastal communities (LMMA 2020) shows a moderate to no increase in people fishing and little increase in breaking of fisheries rules. A third of respondents reported that the cost of staple food items, rice and tinned fish, had increased, particularly in Yap. Staff of the Department of Resources and Development indicate that the stimulus checks from the government tended to mitigate incentives to increase subsistence fishing, and the price of fish for sale increased due to fuel price increases.
- The availability of fish aggregating devices (FADs). There were several FADS in Pohnpei in the years 2020–2022 due to an SPC FAD programme, but the rest of the country have had no FADs for the last 10 years.
- Movement of Chuukese fishers to Guam. According to staff of Guam's Division of Aquatic and Wildlife Resources, in the early 2010s export-oriented fishers from Chuuk experienced a large increase in air freight rates to send fish to Guam. Many fishers reacted by moving their fishing operations to Guam, increasing the fishing effort in Guam and decreasing that of Chuuk (B. Tibbatts, M. Duenas, T. Flores, per. com. November 2022).
- Population changes. Although SPC/Statistics for Development Division (SDD) data show a 2% increase in FSM's total population, government officials report a substantial out-migration of people during the Covid period.

The factors cited above that may have affected FSM's coastal fisheries seem to have had mainly a negative impact on fisheries production.

In terms of dividing coastal fisheries production into commercial and subsistence components, the FSM Integrated Agriculture Census 2016 (Anon. 2019) provides some insight:

> Most of the reported fishing was for home consumption. Few households reported catching any species mainly or only for home consumption. The species that were caught mainly or only for sales varied by state. In Yap and Kosrae less than ten households reported catching any species mainly or only for sale. In Chuuk seven percent of the households that caught oceanic fish (tuna and pelagic) reported that it was mainly or only for sale. In Pohnpei six percent of households that caught oceanic fish (tuna and pelagic) and five percent of households that caught lobster and crab reported that it was mainly or only for sale. Despite this, a much larger number of households sold some part of their fish catch. Coastal reef fish and oceanic fish were the most sold, with 1,648 households reporting selling reef fish (24 percent of those that reported catching these fish) and 952 households reporting selling oceanic fish (31 percent of those that reported catching these fish). For all species, more than 15 percent of households reported selling some part of their catch. And for many households more than half of the catch was sold. For example, 65 percent of those reporting selling oceanic fish said they had sold more than half of their catch. This suggests that although households consider their fishing activity as primarily for home consumption, the income received from selling parts of the catch makes some contribution to the household as well, particularly in Chuuk.

According to the staff of FSM's Division of Marine Resources, recent market prices have ranged from US$2 to US$4 per pound in Pohnpei and Chuuk and somewhat lower in Kosrae and Yap. By comparison, Rhodes at al. (2018) give a price to fishers in Pohnpei in 2015 of US$1.40 per pound.

The data presented in this section are totally inadequate for estimating FSM's coastal fisheries production. By adjusting past estimates, an educated guess of the 2021 coastal fisheries production would be 1,600 t commercial and 3,400 t subsistence, with a value to the fishers of US$7 million for the commercial catch and US$10.5 million for the subsistence catch.

### Coastal subsistence catches

Following from the above section, a crude estimate of the coastal subsistence catch of FSM in 2021 is 3,400 t, worth US10.5 million to fishers.

## Locally based offshore catches

To make an estimate of the volume and value of FSM's locally based offshore vessels with the available information requires the assumption that all "FSM purse seiners" and "FSM longliners" are locally based. This assumption will be re-visited in a section below when determining which of the offshore vessels are actually part of the FSM economy for GDP purposes.

The National Oceanic Resource Management Authority (NORMA) (2022) states the number of FSM fishing vessels by gear in 2021 was 27 purse seiners and 42 longline vessels. These vessels fished actively throughout the western and central Pacific Ocean (WCPO). However, a few of the FSM longliners fished seasonally for albacore tuna in the waters of the Cook Islands. The catches for the purse seine fleet are given in Table 7-2, and those for the longline fleet are given in Table 7-3.

**Table 7-2:** Catches by FSM purse seiners (t)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Bigeye tuna | 1,916 | 3,516 | 3,869 | 3,919 | 3,361 |
| Skipjack | 67,024 | 89,390 | 130,389 | 134,001 | 120,297 |
| Yellowfin tuna | 12,128 | 16,773 | 23,690 | 24,330 | 25,287 |
| Other | 7 | 15 | 17 | 173 | 12 |
| **Total** | **81,075** | **109,694** | **157,965** | **162,423** | **148,957** |

**Table 7-3:** Catches by FSM longliners (t)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Albacore | 517 | 2,066 | 3,841 | 3,262 | 922 |
| Bigeye tuna | 2,131 | 3,048 | 4,548 | 4,193 | 1,606 |
| Pacific bluefin | - | 2 | - | - | 0 |
| Skipjack | 16 | 84 | 301 | 233 | 57 |
| Yellowfin tuna | 1,412 | 2,372 | 4,978 | 4,538 | 1,729 |
| Black marlin | 4 | 12 | 1 | 1 | 0 |
| Blue marlin | 375 | 298 | 615 | 538 | 272 |
| Striped marlin | 1 | - | 3 | 3 | 0 |
| Swordfish | 34 | 51 | 128 | 110 | 34 |
| Blue shark | 1 | - | 2 | 2 | 0 |
| **Total** | **4,492** | **7,934** | **14,418** | **12,880** | **4,621** |

Based on prices from FFA (2022b) and discounting for transshipment expenses (FFA prices are delivered prices), the 2021 purse seine catch of 148,957 t is worth US$180.2 million. For the 2021 longline catch of 4,621 t, using FFA prices and discounting for transshipment results in a value of US$25.4 million. This gives a total locally based offshore catch in 2021 of 153,578 t, with a value of US$205.6 million to the fishers.

### Foreign-based offshore catches

According to the staff of NORMA, foreign-based vessels were subject to strict enforcement of Covid rules, and so many vessels moved to the zones of neighbouring countries, reducing the fishing effort in the FSM zone during the Covid period.

To make an estimate of the volume and value of the catch in the FSM exclusive economic zone (EEZ) by foreign-based vessels with the available information requires the assumption that the catches by "FSM fishing vessels" (as given above) are not included in the "coastal state reporting" section of FSM's report to the Scientific Committee of the Western and Central Pacific Fisheries Commission (NORMA 2022).

NORMA (2022) states that a total of 190 foreign vessels were licensed to fish in the FSM EEZ in 2021. This consisted of 113 purse seiners, 56 longliners and 21 pole-and-line vessels. The reported catch is as follows:

- The provisional 2021 purse seine catch for skipjack, yellowfin and bigeye is estimated to be 66,022 t, 20,718 t and 2,711 t, respectively, for a total of 89,451 t.
- The provisional 2021 longline catch is yellowfin (815 t), bigeye (935 t) and albacore (88 t), for a total of 1,838 t of tuna.
- The provisional 2021 pole-and-line catch is 1,610 t.

Based on prices from FFA (2022b) and discounting for transshipment expenses (FFA prices are delivered prices), the 2021 foreign-based offshore catch is 92,899 t, worth US$121.1 million to the fishers.

### Freshwater catches

The larger islands in FSM have freshwater streams and ponds in which freshwater fish and invertebrates are found, including eels, tilapia and freshwater shrimp. The capture of eels is not large due to cultural attitudes. The capture of tilapia is not large due the perception of it being an invasive species. A small amount of freshwater shrimp is taken and consumed.

For the purposes of the present study, annual freshwater fisheries production in FSM in recent years is estimated to be 1 t, worth US$8,000.

## Aquaculture harvests

A recent regional review of aquaculture (IAS 2022) commented on aquaculture in FSM:

- Current species cultivated commercially: Bath sponges and sea cucumbers (Pohnpei) both small scale, hard and soft coral and clams (Pohnpei) for aquarium trade. Pohnpei operations receive subsidy from various sources. The hatchery on Kosrae is used for commercial production of giant clams and hard corals.
- Current species used for food security & small-scale community-based production: Black pearl oysters continuing under Sea Grant – low scale. Distributed to communities but no commercial operations successful.
- Other species attempted or planned: Milkfish in Yap and Pohnpei – abandoned long ago. Giant clam growout in all states, various hatcheries over the years, sea sponges in all states – except Kosrae

A recent FSM fisheries sector review (Ladner et al. 2021) commented on aquaculture in the country (Box 7-1).

**Box 7-1:** Aquaculture in FSM

Aquaculture in FSM is presently focused in Kosrae, Pohnpei, and Chuk, although various research trials and pilot projects have been conducted in Yap. Most projects have been government or donor driven and have been focused on restocking depleted wild populations and improving local food security and livelihoods. As of 2019, the Micronesia Marketing and Management Enterprises aquaculture operation on Kosrae was reported to be the only true commercial aquaculture operation in the country, but recent interviews indicate that the Marine and Environmental Research Institute of Pohnpei (MERIP) has a commercial operation exporting live corals and giant clams to other wholesalers in Micronesia for re-export. While aquaculture has been widely promoted in FSM both as a commercial enterprise and as a way to help replenish declining fish resources, it has had little success in FSM to date. This has been attributed to limited domestic markets, low capacity to adapt to market trends and fluctuations, high transportation costs, high risk of climate change and other natural disasters, and a lack of infrastructure, capital and skilled labor. According to the Final Report of the Federated States of Micronesia Coastal Fisheries Assessment, aquaculture in FSM is unlikely to become economically viable using the current homegrown approach, but there may be potentially beneficial opportunities if foreign investment is allowed.

Source: Ladner et al. (2021) citing various reports

The operator of the aquaculture facility on Kosrae (M. Selch, per. com. November 2022) kindly provided information on his recent annual production (Table 7-4). The amount in the table for clams includes exports and those for local reseeding, with the number of reseeding clams about five times that for export. The amount in the table for coral is exports only as there were no local sales.

**Table: 7-4:** Annual aquaculture production from the Kosrae Facility (pieces)

| | 2019 | 2020 | 2021 |
|---|---|---|---|
| Giant clam pieces | 115,000 | 16,500 | 27,000 |
| Coral pieces | 16,000 | 9,500 | 23,000 |

In a review of the trade in aquarium products in FSM (McCoy 2020a), it is suggested that a second producer of clams and coral in FSM (i.e. the Marine and Environmental Research Institute of Pohnpei [MERIP]) exported in 2018 about as much coral and about one-third as many giant clams. That study estimated the free-on-board (FOB) value of all 2018 exports (7,752 pieces giant clam and 30,000 pieces coral) to be US$318,000.

The head of MERIP (S. Ellis, per. com. February 2023) stated that their exports using cultured products purchased from farmers averaged US$134,000 per annum in 2021 and 2022 (total $268,000).

During the present study, enquiries were made to various aquaculture stakeholders in FSM (government officials, academics, companies and non-government organisations [NGOs]) about aquaculture production in FSM. The only additional information to that given above is:

- It has been several years since the black pearl project on Nukuoro has produced any pearls.
- There has been seaweed culture in Pohnpei, but now it is virtually non-existent.
- All other aquaculture in FSM is on a very small scale or experimental.

Considering the amount of money used over the last several decades to develop aquaculture in FSM, it is astonishing how little is known about current production. With the readily available information (i.e. that accessible to the present study), it is not even possible to make an educated guess at the current annual aquaculture production in FSM. For the purposes of the present study, the 2021 aquaculture production of FSM is deemed to be 65,000 pieces, with a farm gate value of US$325,000.

## Summary of harvests

From the sections above, a crude approximation of the annual volumes and values[1] of the fishery and aquaculture harvests in 2021 can be made (Table 7-5).

Table 7-5: Annual fisheries and aquaculture harvest in FSM in 2021

| Harvest sector | Volume (t and pcs, where indicated) | Value (US$) |
|---|---|---|
| Coastal commercial | 1,600 | 7,000,000 |
| Coastal subsistence | 3,400 | 10,500,000 |
| Offshore locally based | 153,578 | 205,600,000 |
| Offshore foreign-based | 92,899 | 121,100,000 |
| Freshwater | 1 | 8,000 |
| Aquaculture | 65,000 pcs | 325,000 |
| **Total** | **251,478 t and 65,000 pcs** | **344,533,000** |

[1] The values in the table are dockside/farm gate prices, except in the case of offshore foreign-based fishing, where the value in local waters (overseas market prices less imputed transshipment costs) is given.

Figures 7-1 and 7-2 show the volumes and values of FSM fisheries production in 2021. Aquaculture volume is not shown due to the use of mixed units (pieces and tonnes).

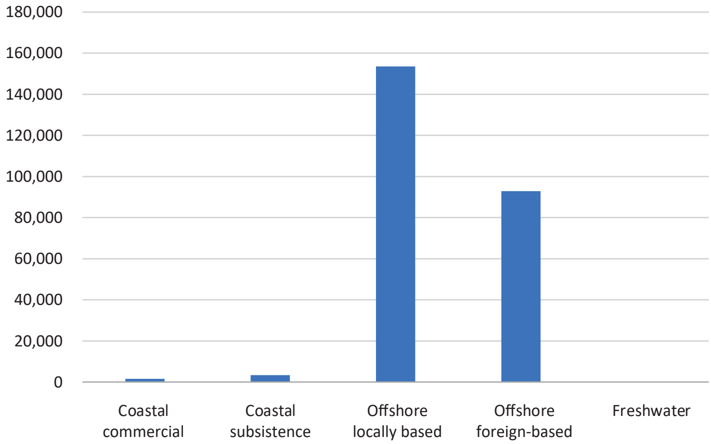



**Figure 7-1:** FSM fisheries production in 2021 by volume (t)

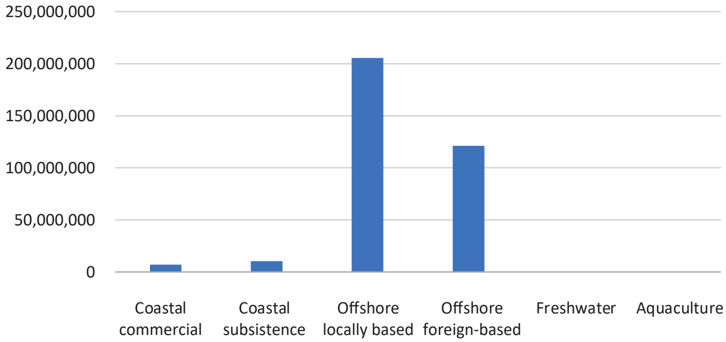



**Figure 7-2:** FSM fisheries production in 2021 by value (US$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The estimated fishery production levels for FSM from those three studies are presented in Table 7-6.[2]

[2] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 7-6: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Value (US$) |
|---|---|---|---|
| Coastal commercial | 1999 | 5,000 | 14,500,000 |
| | 2007 | 2,800 | 7,560,000 |
| | 2014 | 1,725 | 5,000,000 |
| | 2021 | 1,600 | 7,000,000 |
| Coastal subsistence | 1999 | 5,000 | 10,000,000 |
| | 2007 | 9,800 | 15,732,000 |
| | 2014 | 3,555 | 8,800,000 |
| | 2021 | 3,400 | 10,500,000 |
| Offshore locally based | 1999 | 2,499 | 12,495,000 |
| | 2007 | 16,222 | 23,908,377 |
| | 2014 | 40,838 | 85,342,200 |
| | 2021 | 153,578 | 205,600,000 |
| Offshore foreign-based | 1999 | 127,000 | 144,000,000 |
| | 2007 | 143,315 | 177,195,590 |
| | 2014 | 124,481 | 228,148,080 |
| | 2021 | 92,899 | 121,100,000 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 1 | 8,000 |
| | 2014 | 1 | 8,000 |
| | 2021 | 1 | 8,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 16,000 pcs | 80,000 |
| | 2014 | 37,400 pcs and 8 t | 164,800 |
| | 2021 | 65,000 pcs | 325,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring the production (hopefully, an improvement). In the table above the production levels for coastal commercial and coastal subsistence change significantly between the years, but most of that change is due to the way in which the production was estimated (i.e. new sources of information). For example, the drop in production of coastal commercial fisheries between 2007 and 2014 is due to better information becoming available (i.e. the University of Guam studies), rather than a decrease in the amount of fish being harvested. In contrast, changes in production figures in the table for offshore fisheries (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 7.2 Contribution of fishing to GDP

### Current official contribution

The latest year for which an FSM GDP estimation is available is financial year (FY) 2018. Table 7-7 shows the FSM GDP and the fisheries contribution.

**Table 7-7:** Fisheries contribution to GDP (millions of US$)

| | FY 2015 | FY 2016 | FY 2017 | FY 2018 |
|---|---|---|---|---|
| Fisheries contribution to GDP | 12.5 | 19.0 | 24.9 | 17.6 |
| GDP at purchaser's prices | 152.6 | 164.3 | 189.9 | 227.7 |
| Fisheries as a % of GDP | 8.2% | 11.6% | 13.1% | 7.7% |

Source: Department of Resources and Development (unpublished data)

### Method used to calculate GDP

Staff of the Graduate School USA provide technical expertise to FSM in the area of national accounts, including the estimation of GDP. These individuals have a substantial amount of national accounts expertise, as well as many years of experience in Micronesia. For various reasons, they have decided to treat the fishing sector in FSM somewhat differently than, for example, the International Monetary Fund (IMF) and what is described in Appendix 2 of this book (hence "fisheries" instead of "fishing" in Table 7-7 above). The major changes made by the Graduate School are excluding the value added from foreign-owned, locally based fishing vessels but including that for all fish processing and shore-based services of the companies operating the foreign-owned, locally based fishing vessels. According to the individual compiling the GDP data at the Statistics Division (G. McKinlay, per. com. September 2015), the fisheries component includes the following:

- Shore-based services for fishing vessels.
- The two companies considered as resident: Yap State Diving Seagull and Pohnpei's Caroline Fisheries Corporation.
- The onshore operations of the National Fisheries Corporation, Taiyo Micronesia Corporation and Kasar Fishing Corporation (but not their fishing operations).

- Coastal commercial and subsistence fishing.
- Aquaculture (in principle but not in practice due to the difficulty of obtaining data).

### Alternative estimate of fishing contribution to GDP

Following from the above points, to make an alternative estimate of the fishing contribution to GDP, the value of the catch of Diving Seagull and Caroline Fisheries Corporation is required. In Section 7.1 (above), the value of the catch of "FSM longliners" and "FSM purse seiners" is given, but that includes the value of the catch of vessels that are not part of the FSM economy as judged by where their centre of economic interest lies. As explained by the Graduate School (2021a):

> Resident operators have a center of economic and financial interest beyond simply establishing an office or "post office box" in the FSM. Domestic non-resident vessels are likely to have been registered in the FSM to capture economic rents from reduced domestic fishing day rates granted under the FSM arrangement.

The staff of NORMA kindly provided the 2021 catches of Diving Seagull (DS) and Caroline Fisheries Corporation (CFC). Based on prices from FFA (2022b) and discounting for transshipment expenses (FFA prices are delivered prices), the 2021 catch value of the two companies is worth US$35,757,258.

A simplistic production approach to estimating GDP is derived from values of the various types of fishing/aquaculture activities for which production values were determined in Section 7.1 and for purse seining, in the paragraph immediately above. The value added is determined by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3). This procedure for value added estimation is shown in Table 7-8.

**Table 7-8:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (US$) | VAR | Value added (US$) |
|---|---|---|---|
| Coastal commercial | 7,000,000 | 0.75 | 5,250,000 |
| Coastal subsistence | 10,500,000 | 0.85 | 8,925,000 |
| Offshore locally based resident vessels (i.e. DS and CFC) | 35,757,258 | 0.50 | 17,878,629 |
| Freshwater | 8,000 | 0.95 | 7,600 |
| Aquaculture | 325,000 | 0.55 | 178,750 |
| **Total (US$)** | **53,590,258** | -- | **32,239,979** |

Source: Above sections and VARs from Appendix 3

The alternative approach results in a fishing contribution to GDP of US$32.2 million for 2021. This is considerably more than the US$17.6 million estimated for fishing in the official GDP estimate.

## 7.3 Exports of fishery production

The latest available data on fishery exports are given in Table 7-9.

**Table 7-9:** Fishery exports and total exports of FSM

| | | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| Purse seine fish | kg | 22,971,488 | 27,594,755 | 11,436,527 | 16,079,647 | 16,068,277 |
| | US$ | 24,757,526 | 32,716,518 | 31,215,357 | 32,178,860 | 24,587,809 |
| Reef fish | kg | 90,038 | 73,486 | 85,121 | 97,766 | 84,979 |
| | US$ | 342,874 | 314,940 | 334,581 | 384,283 | 366,356 |
| Crab/lobsters | kg | 3,577 | 2,594 | 65,083 | 4,564 | 6,419 |
| | US$ | 15,068 | 15,721 | 401,074 | 33,942 | 42,000 |
| Trochus shell | kg | 0 | 0 | 2 | 0 | 0 |
| | US$ | 0 | 0 | 6 | 0 | 0 |
| Live clams | kg | 1,988 | 8,017 | 6,665 | 4,971 | 6,898 |
| | US$ | 65,111 | 324,581 | 293,280 | 205,722 | 303,520 |
| Other marine products | kg | 1,977 | 1,590 | 20,844 | 26,285 | 21,761 |
| | US$ | 20,819 | 56,453 | 243,775 | 367,811 | 976,678 |
| Total marine products | kg | 23,069,067 | 27,680,443 | 11,614,243 | 16,213,232 | 16,188,334 |
| | US$ | 25,201,397 | 33,428,213 | 32,488,073 | 33,170,618 | 26,276,363 |
| Total exports of FSM | kg | 23,861,605 | 28,627,664 | 12,225,868 | 16,814,114 | 16,925,694 |
| | US$ | 32,832,196 | 41,119,901 | 39,151,730 | 38,956,141 | 30,002,551 |
| Fisheries exports as a % of total exports | kg | 96.7% | 96.7% | 95.0% | 96.4% | 95.6% |
| | US$ | 76.8% | 81.3% | 83.0% | 85.1% | 87.6% |

Source: Graduate School (unpublished data)

It is likely that some of the export categories in the table are underestimated. Some fishers and citizens export quantities of fish to Guam, Majuro, Hawaii and occasionally to the U.S. mainland as personal baggage on passenger aircraft (IAS 2018). Careful monitoring of reef fish exports by a University of Guam researcher for over a decade showed that Chuuk exported to Guam an annual average of about 150 t of reef fish (Cuetos-Bueno et al. 2018).

## 7.4 Government revenue from fisheries

### Access fees for offshore fishing

The latest readily available data on access fees received by FSM are for 2020.

An IMF report (IMF 2021a) indicates that "fishing license fees" remained steady at US$72.3 million for FY 2018 (actual), 2019 (estimated) and 2020 (estimated). The total government revenue (tax, grants and non-tax revenue) for those years was $320.4 million, $320.7 million and $282.5 million, respectively. The "fishing license fees" as a percentage of total government revenue were $22.6% in FY 2018, 22.5% in FY 2019 and 25.6% in FY 2020.

### Other government revenue from fisheries

There is not much readily available information on government revenue from the fisheries sector, other than fishing access fees. In FSM, much of the non-access government revenue from the fisheries sector is acquired at the state level. It is likely state fees for tuna transshipment are the largest non-access source of government revenue.

In the report of the FSM Coastal Fisheries Situation Analysis (IAS 2018), there is some information on non-access government revenue from fisheries:

> The coastal fishery is not taxed directly. Since the people involved in the fishery are subsistence or "artisanal fishers" they are not registered anywhere & there is no licensing system. If they sell their catch they are supposed to be registered as businesses, but they do not register. There is no mechanism available to tax them on income. Exports are not taxed and there is no mechanism to tax exports in the legislation. Some insignificant charges are levied on export certification for fisheries. Income from exports, even if made by a business, is not taxed unless the income from the exports is returned to FSM.

## 7.5 Fisheries-related employment

The report of the FSM Agriculture Census 2016 (Anon. 2019) has information on participation in fisheries:

- In 2016, 8,508 households (55% of households in FSM) stated that they had fished in the past 12 months. Fishing was most reported in Chuuk, where 68% of households had fished. Yap reported 61% of households fished, Kosrae reported 46%, and Pohnpei reported the lowest proportion of households at 41%. This rate of fishing is mostly consistent with the 2013/14 HIES for FSM, except for Chuuk, where the rate of fishing reported was significantly higher than the 49% estimated in 2013.
- Across FSM, 18% of people aged 15 and over worked on fishing activities. Males made up 84.4% of the fishers, while females made up 15.6%. In Yap, 5.5% of those involved in fishing were females, compared to

> 16.5% in Chuuk, 20.2% in Pohnpei and 20.4% of those involved in Kosrae. In Yap, more than 60% of males aged between 35 and 54 were engaged in fishing activities. Note, however, that in Kosrae, there were fewer people reported involved in fishing than the number of households, indicating some underreporting.

The FFA Economic Development Indicators report (Ruaia et al. 2020) provides tuna-related employment data for FSM, which includes harvest, processing and ancillary services sectors, observers and government employees (artisanal sector not included): 2016 (383 people employed), 2017 (670), 2018 (670) and 2019 (502).

In March 2019 SPC conducted a gender assessment of the fisheries sector in FSM (SPC 2019a). The assessment was informed by an extensive literature review and field visits in all four states. Interviews and focus group discussions were conducted with identified stakeholders with support from the FSM government and the respective state fisheries departments. A summary of the results is given in Box 7-2.

**Box 7-2:** Summary of the gender assessment

Compared with findings from a baseline gender and fisheries study conducted by SPC in FSM in 1999–2000, this assessment confirms that in 2019 women in FSM are still active players in the fisheries sector. Better boats, safer equipment and improved telecommunication means fewer risks and augmentation of the wider acceptance of women joining fishing trips. There has also been an increase in the number of women managing the marketing and selling of fish. Despite these changes, the communal acceptance of women who fish is still low. The study also revealed that increased labour mobility of younger men and women to Guam and Hawaii meant the older generation of fishers had to continue to fish and fend for themselves while their children worked abroad to send money home. While for some this meant a new outboard boat, income for medication or other food, elderly men and women fishers often go out fishing together now, more so than 10 to 20 years ago. They do this for the company and for safety reasons. Formal employment in FSM's fisheries sector is very limited, with only about 250 people working for wages, and the majority of these being men. Overall, less than 2% of all wages earned come from formal fisheries-related employment.

Source: SPC (2019a)

## 7.6 Levels of fishery resource consumption

The historical attempts to estimate per capita fish consumption in FSM have been:

- Preston (2000) used 1995 Food and Agriculture Organization (FAO) production, import and export data to estimate the annual per capita fish consumption in FSM to be 72.0 kg.
- Gillett and Lightfoot (2001) state that the annual per capita consumption of fishery products (both imported and local) in FSM is about 114.0 kg. Any fish leakage from tuna transshipment operations must be added to this figure.
- Englberger et al. (2002) is a detailed review of the nutritional literature of FSM. Although there is some mention of fish, there is no mention of per capita fish consumption.
- The Gillett (2009a) study estimates that the consumption of domestic and imported fishery products (including leakage from tuna transshipment operations) in the mid-2000s was 142 kg per person per year.
- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries and territories. The surveys were designed to enumerate fish consumption based on both subsistence and cash acquisitions. For the whole of FSM, the annual per capita fish consumption (whole weight equivalent) was 69.3 kg, of which 92% was fresh fish. For rural areas, the figure for per capita consumption of fish was 76.8 kg, and for urban areas it was 67.3 kg.
- Kronen et al. (2009b) indicate that the average annual per capita consumption of fresh fish at the four sites in SPC's Pacific Regional Oceanic and Coastal Fisheries (PROCFish) project (two in Yap State and two in Chuuk State) was about 63 kg.
- Vali et al. (2014) attempted to reconstruct historical fish catches in FSM. They assumed a per capita subsistence catch rate of 90.71 kg/person/year and a per capita artisanal catch rate of 25.92 kg/person/year.
- Gillett (2016) estimates for 2014 a coastal subsistence fishery production of 3,337 t and a non-exported coastal commercial fisheries production of 1,693 t. The total non-exported coastal production was therefore 5,030 t. With an FSM population of 102,908, that equates to an annual per capita consumption of domestic coastal fishery products of 49.9 kg.

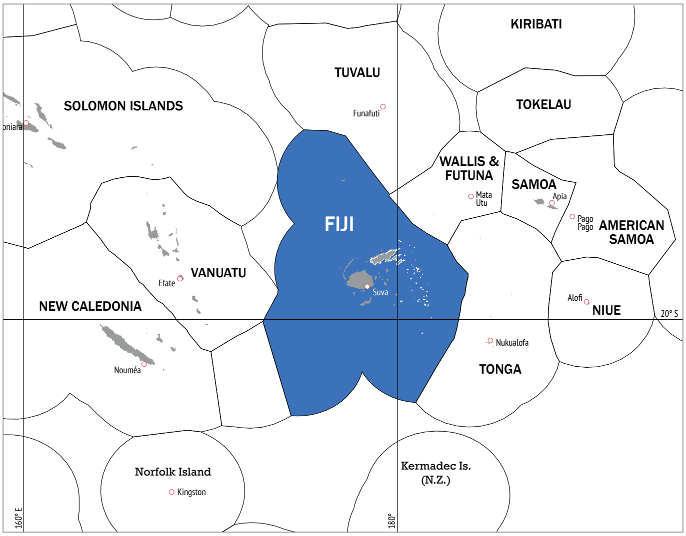
- Rhodes et al. (2015) provide information on fish consumption on Pohnpei, expressed as edible amounts (i.e. food actually consumed, as opposed to whole weight equivalent in the above studies). They estimate that the annual per capita consumption of reef fish, pelagic fish and non-fresh fish on Pohnpei range from 94 to 126 kg. This consumption rate does not consider imported fishery products, local sales of tuna from locally based offshore fishing, or leakage from tuna transshipment operations.

The only readily available recent study relevant to fish consumption in FSM was that done in Chuuk by researchers from the University of Guam. The report of the study (Cuetos-Bueno et al. 2018) showed annual commercial landings in Chuuk were estimated to be 265 t, translating to a mean annual consumption of just 4.3 kg of commercially caught reef fish per person, suggesting the obvious importance of subsistence fishing to Chuuk's supply of fish.

## 7.7 Exchange rates

Federated States of Micronesia uses the US dollar (US$).

# 8 Fiji




## 8.1 Volumes and values of fish harvests in Fiji

### Coastal commercial catches in Fiji

The following describe the major historical attempts to estimate coastal fisheries production in Fiji:

- A study of fish catches for the island of Viti Levu was carried out in June–October 1993 (Rawlinson et al. 1993). The study estimated the total catch made by subsistence fishers from rural Viti Levu to be 3,515 tonnes (t) and the artisanal catch to be 6,206 t.
- Dalzell et al. (1996) estimated a coastal fisheries production of 23,252 t, made up of commercial production of 6,653 t (worth US$18,340,043) and subsistence production of 16,600 t (worth US$45,767,395).
- Several estimates of the magnitude of harvesting by coastal commercial fisheries are provided in government documentation. The "Inshore Artisanal Fisheries" section of the Department of Fisheries Annual Report 2004 (DoF 2005) states that the total quantity of seafood retailed through domestic markets in 2004 was 10,969 t, with a value of F$44,903,587 (Fiji dollars). The document states that this amount had increased 82% over the previous year, which was likely due to an enhanced data collection system.
- The draft Fisheries Department Annual Report 2006 (DoF 2008, 2015) gives information on the "artisanal catch" in 2005 and 2006.

An approximate production of 5,994 t of reef fish and invertebrates was recorded in 2005. Of the total catch landings, 67% were fish and 33% were invertebrates. The value of these landings as estimated from the market prices was approximately F$27 million. An approximate production of 4,922 t of finfish, at a value of F$28.6 million, and of non-finfish, valued at F$18 million, was recorded in 2006.

- Gillett (2009a) considered the past estimates of Fiji's coastal fisheries. Values estimated were the price paid to fishers or (for subsistence catches) the estimated market values minus the estimated costs of getting the catches to markets. The study estimated a coastal fisheries catch of 26,900 t, worth F$108,100,000, made up of a coastal commercial catch of 9,500 t (worth F$54,000,000 to fishers) and a coastal subsistence catch of 17,400 t (worth F$54,100,000 to fishers).

Researchers from the University of British Columbia carried out a study just after the Gillett work (2009a). Starkhouse (2009) considered Gillett (2009a) but was confined to only coral reef species and non-exported products, which is quite different from the "coastal commercial" and "coastal subsistence" of Gillett (2009a). Starkhouse stated the total annual catch volume of reef-associated finfish by artisanal fishing was about 6,401 t, while reef-associated invertebrates and marine plants contributed an additional 1,342 t. Together, reef species were estimated to have a gross market value (60% of which is the price paid to fishers) of US$33.4 million (or US$20 million paid to fishers). The annual subsistence catch comprised of reef-associated species was estimated to be 10,034 t (±2,373 t). The finfish portion of the catch was 8,893 t (±2,096 t), while the invertebrate portion of the catch was 1,141 t (±578 t). The gross value of Fiji's subsistence catch (value to fishers) was estimated to be US$31.0 million (±US$ 7.3 million).

The Institute of Applied Science (IAS) of the University of the South Pacific carried out a survey in 2008/09 of the finfish fishing of 46 villages in 22 districts of 10 provinces in Fiji. The study did not make an estimate of the total national catch but did produce information on catch disposal. Unlike the Gillett (2009a) and Starkhouse (2009) studies, the IAS survey indicated that averaged across Fiji, 71% of fish and invertebrate catch is sold, 22% is used for subsistence, and 7% is given away (IAS 2009).

A study on coastal fisheries in Fiji sponsored by the Packard Foundation examined in detail the recent studies above. The report of the study (Gillett et al. 2014) stated that by far the most thorough survey has been the Starkhouse study, which estimated the total catch for artisanal and subsistence fisheries of reef-associated species to be about 17,777 t, worth US$51 million

(F$94 million) to fishers. The Packard Foundation work stated that the Starkhouse study did not consider exports (it involved only domestically sold products), nor did it consider catches of species not associated with coral reefs. The report concluded that considering these exclusions, the Starkhouse survey results and those of the Gillett (2009a) study are not very different (Gillett et al. 2014).

An International Union for Conservation of Nature (IUCN) study (Gonzalez et al. 2015) that has considerable relevance to valuing coastal fisheries in Fiji was recently carried out under the Marine and Coastal Biodiversity in Pacific Island Countries (MACBIO) Programme. That work focused on the economic evaluation of marine and coastal ecosystem services in Fiji, including subsistence food provision, commercial food harvesting, mineral and aggregate mining, tourism, coastal protection, carbon sequestration, and research and education (Gonzalez et al. 2015). The total production of subsistence fishery in Fiji in 2014 was estimated to be 15,385 t, with a total national value of F$59.04 million. For small-scale inshore commercial fisheries, a total national value of F$14.57–53.69 million was estimated, with the actual volume of commercial production less clear.

The MACBIO study appears to attribute considerable credibility to the household income and expenditure survey (HIES) data (for the subsistence estimate) and the Fisheries Department's market surveys (for the small-scale commercial component). There is a general emerging sentiment among fisheries specialists in the region that "old style" HIES surveys underestimate fisheries production. The Gillett et al. (2014) study examined the Fisheries Department's market surveys and commented: "The statistical system that is used to provide coastal fisheries data in Fiji is now no longer functional, primarily due to the prioritisation of scarce government resources…The statistical system has broken down. No enumerator in the Central Division for 3 years. Different systems for the 4 divisions; one junior staff at HQ with no statistical expertise is in charge of compiling statistics from the 4 divisions. Little technical expertise provided by the regional organisations." The MACBIO study valued subsistence production by the cost of buying an equivalent protein food, whereas the Gillett study used the farm gate method. Although either method may be justified, the resulting values could be quite different.

Gillett (2016) was the third edition in the series of "Benefish" books. That study considered the coastal fisheries production in the second Benefish edition (Gillett 2009a), examined the population change of the country in the period 2007–2014, the focus of the Ministry of Fisheries, recent developments in the fisheries sector, changes in fishery exports of the country, and changes in prices for domestically consumed coastal fishery products. It concluded that a crude approximation of the coastal fisheries production in Fiji in 2014 was 27,000 t (worth F$133 million), made up of a coastal commercial catch of 11,000 t (worth F$75 million to fishers) and a coastal subsistence catch of 16,000 t (worth F$58 million to fishers).

In the period 2016–2022, there were a few studies relevant to updating the above estimate of coastal fisheries production. A study funded by the Packard Foundation (Lee et al. 2018) examined the data from fish market surveys as several past estimates of coastal fisheries production in the country had relied heavily on those surveys. The report of the study stated:

> For several decades the Fisheries Department surveyed municipal, non-municipal markets, other outlets and roadsides in the Central, Western, and Northern Divisions for the sales of finfish and non-finfish and published estimates of those sales in the Department's annual report. Detailed reporting of catches ceased in 2004 and summary reporting continued to 2013, with a gap for 2011 and 2012. The end result is that there have been no reliable production data for inshore fishery resources for more than ten years, making it impossible to monitor trends in production.

In early 2019 there was a study of Fiji's domestic fish trade (Gillett and Musadroka 2019). That study involved work in the greater Suva area, with excursions to Vanua Levu (Labasa, Nabouwalu and Savusavu), Kadavu (Vunisea) and around Viti Levu (Navua, Sigatoka, Nadi, Namaka, Lautoka, Ba, Tavua, Rakiraki, Korovou and Nausori). Interviews were carried out with 87 individuals, including people at the Ministry of Fisheries, shipping companies, fish vendors, non-governmental agencies (NGOs), seafood/transport firms, ice-plant operators, universities and fisher associations. The results of that study are provided in Table 8-1. When considering the results in the table, it should be noted that the amounts given are the flow of fish from one area to another and not the total production of the originating area. The most surprising result of the survey was the huge size of the Labasa–Suva fish trade (5,000 t/year), which is close to past estimates by the Ministry of Fisheries of *all* coastal commercial fish production in the entire country.

Table 8-1: Estimates of the major flows of fish in Fiji's domestic fish trade

| Areas involved | Tonnes of fish per year | Comments on the quality of estimate |
|---|---|---|
| Labasa > Suva (Macuatu & Bua to Viti Levu) | 5,000 | The estimate should be considered indicative. Based on 15 days of census of trucks transporting fish. The major uncertainty is extrapolating weekly data to obtain the annual estimate. |
| Ba > Western Division hotels & urban areas to the east of Ba | ??? | The amount appears to be substantial (perhaps several hundred tonnes) as Ba supplies much of the fish to Lautoka (about half the fish in the town market is from Ba), Nadi/Namaka (from 50 to 80%), and Sigatoka (almost all) – but there is no estimate of fish amounts at the landing sites, retail sites, or hotels/restaurants. |
| Other area of Central Division > Suva | 500 | Crude guess |
| Lomaiviti > Suva | 125 | Educated guess |
| Kadavu > Suva | 100 | Educated guess |
| Lau > Suva | 50 | Educated guess |
| Coastal fishery exports | 450 | Fairly accurate; exports are closely monitored, but problems may exist in (a) extracting coastal fishery food exports from the listing of all fishery exports (i.e. that from aquaculture, non-food, and re-exports), and (b) species identification |
| Longline bycatch sold domestically | 4,100 | Accurate; the domestic sales are monitored and reported in the Fiji government reports to WCPFC. The 4,100 tonnes is the average of the 2016 and 2017 domestic sales. |
| Longline exports | 12,000 | Accurate; the exports are monitored and reported in the Fiji government reports to WCPFC. The 12,000 tonnes is the average of the 2016 and 2017 exports. |

Source: Gillett and Musudroka (2019)

An IAS study (2020)[1] carried out one-week creel surveys at 12 villages in the four divisions of Fiji. The results showed a mean annual catch per village of 11,949 kg to come up with 7,600,106 kg for the "national annual coastal village finfish production", indicating that the study used 639 villages for extrapolating the results to the national level. Other studies assume a much greater number of coastal villages in Fiji.[2] Also to be considered is the very low weekly catch of some of the 12 villages in the IAS study used for extrapolation (e.g. 2.58 kg/week; 13.11 kg/week). The estimation of a "national annual coastal village

[1] This is a further analysis of the data given in the IAS (2009) study mentioned above.

[2] For example, Govan (2015), using data from the Native Lands and Fisheries Commission of the Ministry of Itaukei Affairs, indicates 848 coastal villages and settlements.

finfish production" in the IAS study differs considerably from the present study's estimation of the current national coastal fisheries production in that (a) the coastal fisheries production from urban-based fishers was not included, and (b) invertebrate (i.e. non-finfish) production was not included. Also noteworthy is that the data of the IAS study are from the period 2007–2012.

In 2019/20 a HIES was carried out in Fiji. Detailed results of the survey that would enable a fisheries assessment have not been released by the Fiji Bureau of Statistics.

A Packard-funded study (Gillett 2020b) estimating the coastal fisheries production of Fiji considered all studies in the previous two decades, estimated the throughput of fish at 14 major fish markets in the country, and considered the recent work on the aquarium fish trade, trochus trade, fish market statistics and per capita fish consumption. It also examined the impact of the sea cucumber ban, seasonal ban on groupers, coastal fishery developments and urbanization. In summary, the report of the study stated:

> A crude estimate of coastal fisheries production in Fiji in 2019 is about 26,200 tonnes, worth F$153.3 million to the fishers. This is made up of about 10,200 tonnes of coastal commercial production, worth F$64.8 million, and 16,000 tonnes of coastal subsistence production, worth F$88.5 million.

To adjust this 2019 estimate for 2021 (the focal year of the present study) requires consideration of the impacts on coastal fish production of the sea cucumber ban and of Covid. As for sea cucumber, when there is no harvesting ban, the value of sea cucumber is quite large. Govan and Bertram (2020) indicate that in 2017 the sea cucumber exports of Fiji were worth F$10 million. A ban covering the harvesting and export of sea cucumber covering the period 2018–2021 was lifted on July 1, 2022. The value of sea cucumber harvesting (i.e. zero) was therefore the same in 2019 and in 2021.

As for the impacts of Covid on coastal fisheries production in Fiji, a report by the Organisation for Economic Co-operation and Development (OECD) states that amid the pandemic, three tropical cyclones hit the country, namely "Harold" in April 2020, "Yasa" in December 2020 and "Ana" in January 2021. Due to Covid and cyclones, many Fijians previously employed in the tourism sector returned to their villages and survived on fishing and farming activities for self-consumption (OECD 2022). The Institute of Marine Resources at the University of the South Pacific conducted a survey in collaboration with the Wildlife Conservation Society to gain insights into the impact of Covid on iTaukei Fijians working in the commercial coastal fisheries sector. It concluded that the main effects of Covid were a drop in the sales and price of local fish as supply exceeded demand, especially during lockdown (IMR and WCS 2020).

It is believed that the 2019 study (Gillett 2019b), however crude, is currently the best available assessment of the production from Fiji's coastal fisheries. Adjusting the results of that study for 2021 is difficult due to lack of data. Intuitively, it seems that production increased and value declined, but the amount of change is unknown. For the purposes of this study, the 2021 coastal fishery production of Fiji is assumed to be 15% greater in volume and 10% less in value than that of the 2019 study.

In summary: A crude estimate of coastal fisheries production in Fiji in 2021 is about 30,100 tonnes, worth F$138 million to the fishers. This is made up of about 11,700 tonnes of coastal commercial production, worth F$58 million, and 18,400 tonnes of coastal subsistence production, worth F$80 million.

### Coastal subsistence catches

It is important to provide some background on the older estimates of subsistence production by the Fisheries Department. For many years, the subsistence estimates given in the annual reports were based on a 1979 small-scale fishing survey which covered only Viti Levu and relied on the ability of a single respondent in each village to recall landings over the previous 12 months (G. Preston, per. com. August 2001). For over three decades the estimate of small-scale production for all of Fiji (the largest component of the domestic catch) has been made simply by adding 200 t of fish to the unreliable 1979 figure. For example, the 2004 Annual Report of the Fisheries Department (DoF 2005) gives subsistence fishery harvests, as follows: 2000, 18,000 t; 2001, 18,200 t; 2002, 18,400 t; 2003, 18,600 t; and 2004, 18,800 t. It is notable that the results of a small-scale fisheries survey in 1993 (Rawlinson et al. 1993) were not used to modify the 1979 estimate.

In the Starkhouse (2009) study, the subsistence catch was estimated to be 10,034 t, which is much lower than the estimates in the annual reports of the Fisheries Department. Starkhouse has indicated that this is because of the inadequacies of the 1979 survey and the flawed practice of adding 200 t each year given recent temporal and spatial population growth patterns (B. Starkhouse, per. com. August 2008).

Following the logic in the above section on coastal commercial catches, the best estimate of the subsistence production in Fiji is to be obtained by adjusting the results of the 2019 study. Accordingly, the best estimate of Fiji's subsistence production in 2021 is 18,400 t of finfish and invertebrates, worth F$80 million.

## Locally based offshore catches

Estimations of the volume and value of the production of Fiji's locally based offshore fleet are from a Forum Fisheries Agency (FFA) spreadsheet (FFA 2022b), supplemented by information from the paper presented by the Ministry of Fisheries to the Western and Central Pacific Fisheries Commission (WCPFC) Scientific Committee (OFD 2022). The values obtained in the table below have been adjusted to take into consideration (a) the bycatch (the FFA spreadsheet is only concerned with tuna catches) and (b) transport charges (the FFA spreadsheet only gives values at overseas markets). The values listed in Table 8-2 are therefore equivalent to Fiji dockside prices (i.e. prices paid to fishers).

**Table 8-2:** Volumes and values of the catch of Fiji's longline fleet

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Tuna and bycatch volume (t) | 19,520.0 | 15,851.0 | 16,361.0 | 13,950.0 | 10,828.0 |
| Tuna and bycatch value (in-zone, F$ millions) | 149.1 | 123.1 | 142.8 | 125.3 | 84.6 |

Source: FFA (2022b) and OFD (2022), with adjustments

As with all national fleets covered in the present study, unless there is information to show otherwise, all locally based offshore vessels (regardless of their registration or ownership) are assumed to have their centre of economic activity in Fiji and are therefore part of the Fiji economy and contribute to the country's GDP.

The focal year of this study, 2021, was not typical. The volume and value of the production from Fiji's offshore fleet in that year of 10,828 t was considerably less than the 2017–2019 average of 17,244 t. According to the Fiji Fishing Industry Association (A. Raiwalui, per. com. November 2022), the fresh fish longliners were negatively affected much more than the frozen fish longliners due to erratic and expensive air freight service to destination markets. The Offshore Fisheries Division (OFD 2022) reports that because of Covid, most fresh fish vessels were fishing either at their lowest efforts or not at all.

## Foreign-based offshore catches

In Fiji's report to the WCPFC Scientific Committee, no foreign-based offshore catches were reported to have been made in the country's exclusive economic zone (EEZ) in 2020 and 2021, and thus it is assumed that no such catches were made during those years. For many years, the only foreign vessels licensed to fish in Fiji's zone have been U.S. purse seiners under the multilateral treaty to which Fiji is a party.[3] Their fishing in the Fiji zone is sporadic and minimal (e.g. 162 t in 2013).

## Freshwater catches

Harvests of freshwater finfish and invertebrates in Fiji consist mainly of freshwater clams (*Batissa violacea*), eels, mangrove oysters, various species of freshwater crustaceans and introduced fish such as tilapia and carps.

There is no consolidated accounting of the catches of these species, but the fragmented information that does exist provides some help in determining the overall harvest level:

- A freshwater clam, known locally as *kai (Batissa violacea),* is found in all major river systems in Fiji and is the basis of the largest freshwater fisheries in the country and one of the top three in the Pacific region. The *kai* fishery is distinct in that it is dominated by women, who can spend three to four hours per day, four to five days per week, free-diving for *kai,* which are then sold at roadside stalls or in local markets (IUCN 2014).
- The Fisheries Department Annual Report 2004 (DoF 2005) provides the amounts of various fishery products sold in municipal and non-municipal markets in 2004. At the two types of markets, 2,526 t of *Batissa* were sold for a total price of about F$2.2 million, and 500 t of various species of freshwater crustaceans were sold for a total price of about F$6 million.
- Richards (1994) reports that annual market sales of *Batissa* ranged from 1,000 t to 1,800 t in the period 1986–1992.
- Fisheries Department staff indicated that the harvest of clams/crustaceans for non-market purposes is probably less than what is marketed.
- Kinch et al. (2019) describe the fishery and potential for Fiji's mangrove oysters.
- Eels are taken in fresh water in Fiji. Nandlal (2005) reports eels are an important source of protein for the rural population, but Richards (1994) states there is not a strong local demand for freshwater eels, and there is no organised fishery for them. Pickering and Sasal (2017) contains information that indicates that although eels are not the subject of any periodic and specifically targeted fisheries survey work in Fiji, they are a component of general fishery surveys and resource inventories conducted by the Ministry. The most recent such survey was of the fisheries resources of the Sigatoka River, completed in 2015.

[3] Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America.

- Thaman (1990) indicates that flagtails (*Kuhlia* spp.) and a number of goby species are important for interior villages, but that abundance has decreased in recent years.

The number of fish species in Fijian rivers has been significantly affected by a loss of catchment forest cover and the introduction of tilapia. On average, stream networks with established tilapia populations have 11 fewer species of native fish than do intact systems (Jenkins et al. 2009). Any estimate of the production of Fiji's freshwater fisheries necessarily involves substantial guesswork. Gillett (2016) made an educated guess that Fiji's freshwater fisheries produced about 3,700 t, with a value to fishers of F$7,400,000.

In a section above it is stated that in 2020 and 2021 due to Covid and cyclones (a) many Fijians previously employed in the tourism sector returned to their villages and survived on fishing and farming activities for self-consumption, and (b) the price of local fish dropped as supply exceeded demand. Applying these concepts to freshwater fishing, it can be speculated that harvesting increased and the value of the catch decreased (by unknown amounts). For the purposes of the present study, the production of Fiji's freshwater fisheries in 2021 is deemed to be 4,000 t, worth F$7,000,000.

### Aquaculture harvests

Aquaculture efforts in Fiji have involved attempts to raise many different types of organisms over the last 100 years, including tilapia, carp, freshwater shrimp, penaeid shrimp, milkfish, seaweed, giant clams, trochus, pearl oysters, milkfish, beche-de-mer, sponges, turtles, crabs and corals. The primary focus of the Ministry of Fisheries in the last few years has been on tilapia and prawns.

A surprising feature of aquaculture in Fiji is the lack of knowledge of overall production. The absence of a formal system for collecting aquaculture statistics makes it difficult to obtain a good idea of production volumes and values. On a simpler level, there have been few efforts to use various types of local knowledge to make gross estimates of production of the major aquaculture commodities (which could be refined over time). Consequently, several aquaculture specialists in Fiji are hesitant to venture even a guess at the annual production of the various commodities. In the present study, to get a crude idea of aquaculture production, discussions were held with farmers, aquaculture staff of the Ministry of Fisheries, academics and an author of a recent regional review of aquaculture.

In terms of volume and numbers of farms, tilapia is the major aquaculture activity in Fiji, and therefore the estimation of the annual production and its value deserves special attention.

- The price of tilapia at first sale varies considerably across Fiji, and much production is not sold (i.e. it is used for subsistence purposes). The aquaculture staff of the Ministry of Fisheries suggest a price of first sale of F$6 per kg, but the largest tilapia producer indicates F$8 is more accurate.
- During the present study, a group discussion was held with aquaculture field staff of the Ministry. That meeting indicated that by taking the likely number of active tilapia farms, their sizes, and the associated average annual production, a crude estimate of total annual tilapia production is around 265 t.
- Alternatively, the above discussion also considered tilapia production from the distribution of tilapia fry. Ninety percent of tilapia farmers obtain their tilapia fry from the three main hatcheries in Fiji. Considering the number of tilapia fry supplied in recent years, the likely mortality rate, and the time to reach harvesting size, it is estimated about 240 t may be produced annually in the country.
- A recent review of aquaculture in the region (IAS 2022) states (a) for tilapia in Fiji, the real production is probably 150–200 t, and (b) there was a huge increase in demand for tilapia during Covid.
- The largest tilapia producer in the country has indicated that their production alone in 2021 was 145 t of whole tilapia, and that national production is in the 380–450 t range.

Considering the above information, the 2021 production of cultured tilapia in Fiji is likely to be around 300 t, with a farmgate value of F$2.1 million.

There are two major producers of pearls in Fiji. One producer claims they harvest 7,000 to 10,000 pearls per year and states the other producer (who has not volunteered any information for the present study) harvests about two to three times that amount (C. Provost, per. com., October 2022). Export statistics are not very helpful for estimating production because (a) the value of pearls is combined with other commodities to form the category "pearls, precious, semi-precious, stones and metals", and (b) a significant number of pearls are sold domestically and do not appear in the export statistics. The information available to the present study is insufficient for estimating the volume or value of pearl production in the country. The 2021 production of pearls is deemed to be 20,000 pearls, with a farm gate value of F$3 million.

Prawn culture in Fiji is carried out for both brackish water (penaeid) and freshwater (*Macrobrachium*) prawns. According to staff of the Ministry of Fisheries, there are about 10 semi-commercial producers and one fully commercial producer of penaeid shrimp in the country (E. Meo, per. com. October 2022). According to aquaculture staff of the University of the South Pacific, *Macrobrachium* production was about 4–5 t in 2021 (R. Prasad, per. com. October 2022). With so little readily information on prawn culture in Fiji, it is difficult to venture even a semi-educated guess on the total production. The 2021 production of prawns is deemed to be 25 t, with a farm gate value of F$875,000.

Seaweed aquaculture production is relatively easy to estimate from export records. In 2020, 15 t was produced and in 2021, 26 t was produced. At F$1.50 per kg dry weight, this was worth F$39,000 to the farmers in 2021.

Small amounts of other aquaculture commodities were produced in 2021: grass carp, oysters for the tourist trade, oyster spat, rabbitfish, mullet, grouper experimental and sea cucumber (IAS 2022). Giant clam culture and coral culture were halted in 2021 and 2018, respectively, due to the inability to obtain export permits (C. Provost and W. Smith, per. com. October 2022).

A summary of Fiji's aquaculture production in 2021 is given in Table 8-3.

Table 8-3: Aquaculture production in Fiji in 2021

| Commodity | 2021 production volume (t or pcs) | 2021 production value (F$) |
|---|---|---|
| Tilapia | 300 t | 2,100,000 |
| Pearls | 20,000 pieces | 3,000,000 |
| Prawns | 25 t | 875,000 |
| Seaweed | 26 t | 39,000 |
| **Total** | **351 t and 20,000 pcs** | **6,014,000** |

## Summary of harvests

Using the above information, a rough approximation of annual volumes and values[4] of the Fiji harvest in 2021 can be made (Table 8-4).

**Table 8-4:** Annual fisheries and aquaculture harvest in Fiji in 2021

| Harvest sector | Volume (t and pcs, where indicated) | Value (F$) |
|---|---|---|
| Coastal commercial | 11,700 | 58,000,000 |
| Coastal subsistence | 18,400 | 80,000,000 |
| Offshore locally based | 10,828 | 84,600,000 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 4,000 | 7,000,000 |
| Aquaculture | 351 t and 20,000 pcs | 6,014,000 |
| **Total** | **45,279 t and 20,000 pcs** | **235,614,000** |

Source: Above sections of this report

The extremely weak factual basis for the coastal, freshwater catch and aquaculture estimates is acknowledged.

[4] The values in the table are dockside/farm gate prices, except in the case of offshore, foreign-based fishing, where the value in Fiji waters (overseas market prices less imputed transshipment costs) is given.

Figures 8-1 and 8-2 show the volumes and values of the 2021 Fiji fisheries production. Aquaculture is not shown in the volumes figure due to the use of mixed units (pieces and tonnes).

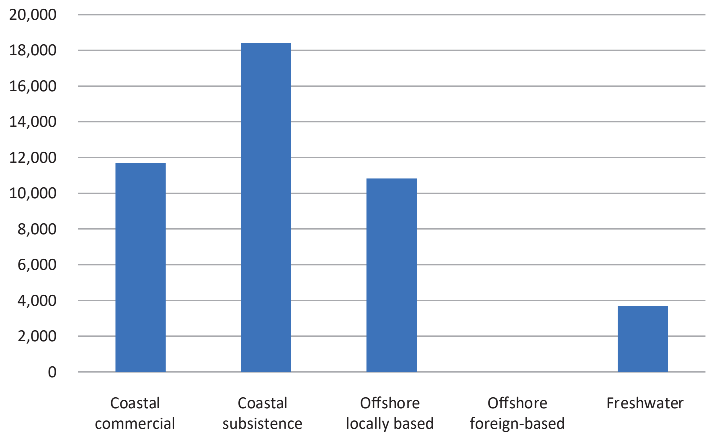



**Figure 8-1:** Fiji fisheries production in 2021 by volume (t)

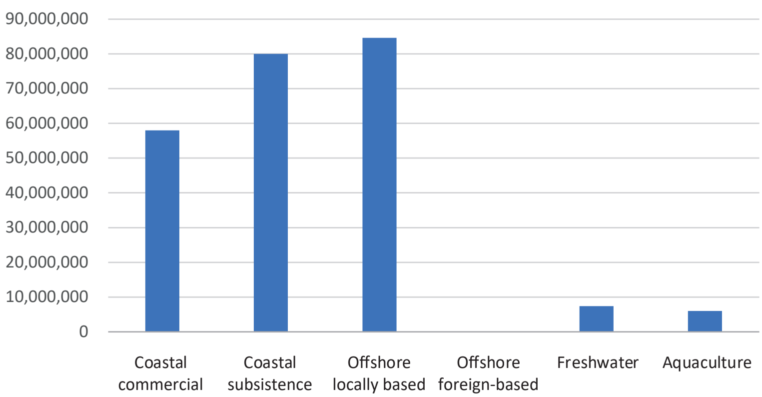



**Figure 8-2:** Fiji fisheries production in 2021 by value (US$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The estimated fishery production levels for Fiji from those four studies are presented in Table 8-5.[5]

**Table 8-5:** Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (F$) |
|---|---|---|---|
| Coastal commercial | 1999 | 9,320 | 30,000,000 |
| | 2007 | 11,000 | 75,000,000 |
| | 2014 | 9,500 | 54,000,000 |
| | 2021 | 11,700 | 58,000,000 |
| Coastal subsistence | 1999 | 21,600 | 48,600,000 |
| | 2007 | 16,000 | 58,000,000 |
| | 2014 | 17,400 | 54,100,000 |
| | 2021 | 18,400 | 80,000,000 |
| Offshore locally based | 1999 | 5,500 | 50,500,000 |
| | 2007 | 13,744 | 46,870,000 |
| | 2014 | 17,079 | 107,642,610 |
| | 2021 | 10,828 | 84,600,000 |
| Offshore foreign-based | 1999 | 917 | 1,093,000 |
| | 2007 | 492 | 844,000 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 3,731 | 7,408,000 |
| | 2014 | 4,140 | 6,860,000 |
| | 2021 | 4,000 | 7,000,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 204.682 t and 85,236 pcs | 2,875,567 |
| | 2014 | 247 t and 48,100 pcs | 2,799,000 |
| | 2021 | 351 t and 20,000 pcs | 6,014,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

[5] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for coastal commercial, coastal subsistence and freshwater change significantly between the years, but most of that change is due to the way in which the production was estimated. For example, the drop in production of coastal subsistence fisheries between 2007 and 2014 is due to better information becoming available (through the results of the Starkhouse study), rather than a decrease in the amount of fish being harvested.

## 8.2 Contribution of fishing to GDP

### Current official contribution

The official contribution of fishing and aquaculture to Fiji's GDP in recent years is given in Table 8-6.

**Table 8-6:** Official contribution of fishing and aquaculture to GDP (F$ millions)

| | 2018 | 2019 | 2020 | 2021 p |
|---|---|---|---|---|
| Fishing & aquaculture | 91.2 | 83.6 | 77.4 | 66.8 |
| Fiji GDP | 11,650.6 | 11,842.6 | 9,709.8 | 8,895.9 |
| Fishing & aquaculture as % of GDP | 0.78% | 0.71% | 0.80% | 0.75% |

Source: Fiji Bureau of Statistics website (www.statsfiji.gov.fj); p = provisional; the GDP is at current basic prices

Upon enquiry to the Fiji Bureau of Statistics, the gross output, intermediate costs and value added were provided for the four years (Table 8-7).

**Table 8-7:** Output, intermediate costs and value added for the fishing and aquaculture contribution (F$)

| | | 2018 | 2019 | 2020 | 2021 p |
|---|---|---|---|---|---|
| Total fishing and aquaculture | Gross output | 158,410,933 | 153,627,966 | 139,248,650 | 116,469,124 |
| Total fishing and aquaculture | Intermediate cost | 67,163,226 | 70,028,287 | 61,838,040 | 49,625,196 |
| Total fishing and aquaculture | Value added | 91,247,707 | 83,599,679 | 77,410,610 | 66,843,928 |

Source: Fiji Bureau of Statistics, unpublished data; p = provisional; the GDP is at current basic prices

## Method used to calculate the official fishing contribution to GDP

Discussions with staff of the Fiji Bureau of Statistics provided information on the methodology used to estimate the contribution of fishing and aquaculture to Fiji's GDP (B. Krishna, per. com. December 2022).

- The basic methodology for dealing with fishing and aquaculture has not changed in the last decade.
- The market component of the fishing and aquaculture contribution is estimated from surveys of fishing companies and information from the Planning and Policy Division of the Ministry of Fisheries. The non-market component is from household income and expenditure surveys that are periodically carried out by the Fiji Bureau of Statistics.
- The market sector is sub-divided into 9 sub-sectors, as shown in a Fiji Bureau of Statistics publication (Table 8-8) for the year 2019.

**Table 8-8:** Fishing/aquaculture market sector GDP contributions in 2019 (F$)

| | | Gross value of output | Intermediate consumption | Value added |
|---|---|---|---|---|
| | Fishing and aquaculture | 115,093,882 | 61,537,331 | 53,556,551 |
| 03111 | Marine fishing on a commercial basis | 110,395,498 | 59,380,946 | 51,014,552 |
| 03112 | Taking of marine crustaceans and molluscs | 0 | 0 | 0 |
| 03122 | Taking of freshwater crustaceans and molluscs | 2,463,846 | 721,181 | 1,742,665 |
| 03114 | Bêche-de-mer | 0 | 0 | 0 |
| 03115 | Gathering of other marine organism and materials | 38,018 | 29,211 | 8,807 |
| 03121 | Freshwater fishing on a commercial basis | 0 | 0 | 0 |
| 03124 | Gathering of freshwater materials | 0 | 0 | 0 |
| 03211 | Marine aquaculture | 375,000 | 308,620 | 66,380 |
| 03222 | Freshwater aquaculture | 1,821,520 | 1,097,373 | 724,147 |

Source: FBOS (2022c)

It is notable that a publication of the Fiji Bureau of Statistics (FBOS 2022c, Appendix 4) indicates that the contribution of the market sector is 98.8% of the total fishing/aquaculture GDP contribution and that of the non-market sector is 1.2%.

## Alternative estimate of fishing contribution to GDP

Table 8-9 below represents an alternative to the official method of estimating fishing contribution to GDP in Fiji. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 8-1 above (summarised in Table 8-4) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 8-9 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

**Table 8-9:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (F$, from Table 8-4) | VAR | Value added (F$) |
|---|---|---|---|
| Coastal commercial | 58,000,000 | 0.55 | 31,900,000 |
| Coastal subsistence | 80,000,000 | 0.80 | 64,000,000 |
| Offshore locally based | 84,600,000 | 0.20 | 16,920,000 |
| Freshwater | 7,000,000 | 0.90 | 6,300,000 |
| Aquaculture | | | |
| Pearls | 3,000,000 | 0.45 | 1,350,000 |
| Other aquaculture | 3,014,000 | 0.73 | 2,200,220 |
| **Total** | **235,614,000** | -- | **122,670,220** |

The total value added in Table 8-9 (F$122.7 million) is much greater than the official value added of F$66.8 million. The alternative estimate equates to the fishing contribution being 1.38% of Fiji's GDP.

The following should be noted in comparing the official and alternative 2021 contributions:

1. In the official estimates, the contribution of the non-market market sector is only 1.2% of the fishing/aquaculture GDP contribution (FBOS 2022c, Appendix 4). In the alternative estimates, the non-market sector (i.e. coastal subsistence fishing) is 52% of the fishing/aquaculture GDP contribution. This is based on a 2021 gross output of F$80 million with a value-added ratio of 0.80 (Table 8-9). The implication is that the non-market contribution in the official estimate seems too small.

2. The nine categories for market sub-sectors of the fishing sector used in making the official estimate (Table 8-8 above) (a) do not relate nicely to the realities of how fishing production is estimated, and (b) the value-added ratios of the various fisheries within the categories are very different. For example, the category "marine fishing on a commercial basis" would include such diverse activities as industrial longline fishing and spearfishing for reef fish. These features complicate the estimations of the value added.

To reconcile point #1 above, a discussion was held with staff of the Fiji Bureau of Statistics (B. Krisna, per. com. December 2022). It was explained by the staff that the 2014 household income and expenditure survey showed a contraction of subsistence fishing, hence the reduced valued added from that type of fishing.

From the fisheries perspective, subsistence fishing remains considerable in Fiji, with recent surveys and local knowledge showing its contribution to GDP is likely larger than coastal commercial fishing – and certainly not the 1.2% of GDP as stated by the Fiji Bureau of Statistics (i.e. subsistence fishing shrinking to almost zero). Furthermore, surveys in 2020 and 2021 indicate that due to Covid, a substantial number of people in Fiji lost their formal jobs and moved to their villages to participate in subsistence activities.

## 8.3 Exports of fishery production

Table 8-10 gives the value of fish exports from Fiji for the period 2015 through 2021 and compares the amounts to all exports of the country. The table covers product category Harmonized System (HS) code HS 03[6], which is defined to be "fish and crustaceans, molluscs and other aquatic invertebrates".

**Table 8-10:** Fiji's fish exports

| | HS 03 exports | Total exports | HS 03 as % of total exports |
|---|---|---|---|
| | Thousands of F$ | | |
| 2015 | 83,272 | 1,150,969 | 7.23 |
| 2016 | 112,727 | 1,136,092 | 9.92 |
| 2017 | 90,758 | 1,192,862 | 7.61 |
| 2018 | 84,278 | 1,174,971 | 7.17 |
| 2019 | 93,176 | 1,167,110 | 7.98 |
| 2020 | 66,628 | 1,143,126 | 5.83 |
| 2021 | 54,510 | 1,251,451 | 4.36 |

Source: SPC/SDD

[6] The Harmonized Commodity Description and Coding System (HS) is an international system for classifying products for customs and trade statistics purposes.

Table 8-10 is restricted to category HS 03 and therefore does not include HS 16, which consists of "preparation of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates". HS 16 includes cooked loins and canned fish, which are important Fiji exports. In 2020 Fiji exported F$16,470,012 worth of HS 16 fish products. The combined total of Fiji's HS 03 and HS 16 fish exports represented 7.3% of all exports in 2020.

Fiji exports fishery products originating from both offshore fisheries (i.e. longlining) and coastal fisheries. A study of the fish trade in Fiji (Gillett and Musadroka 2019) shows that in the period 2016–2019, Fiji exported annually about 450 t of fish from coastal fisheries and 12,000 t of fish from offshore longlining.

The most valuable non-tuna fish export of the country is processed sea cucumber (beche-de-mer). When there is no harvesting ban, the value of sea cucumber exports can be quite large. Govan and Bertram (2020) indicate that in 2017 the sea cucumber exports of Fiji were worth F$10 million. There was a ban covering the harvesting and export of sea cucumber during the period 2018–2021, with the ban being lifted on July 1, 2022.

Fiji exports a large amount of tuna. In Fiji's export trade statistics, it is not easy to determine tuna exports because some of the HS codes for fish in the Fiji Bureau of Statistics export trade data could contain tuna and/or coastal fishery products. For example, the trade statistics show that in 2020, F$1 million of "Other fish" were exported.

Using a variety of sources, FFA (2022a) reports that in the three-year period 2018–2020, an annual average US$117 million worth of tuna was exported from Fiji. Another FFA report (McCoy 2015) shows the various tuna products and destination markets (Table 8-11).

**Table 8-11:** Average annual volumes and values of Fiji tuna exports

| | Product category | Volume (t) | Value (US$) | Destinations by value (%) |
|---|---|---|---|---|
| USA market | Whole round | 1,506 | 5,875,203 | USA (100) |
| USA market | Fresh and frozen, value added | 430 | 2,420,383 | USA (100) |
| Non-USA market | Fresh tuna | 802 | 7,673,678 | Japan (83)<br>New Zealand (11)<br>Australia (5)<br>Others (1) |
| Non-USA market | Frozen tuna | 6,430 | 19,503,833 | Japan (59)<br>Thailand (22)<br>Korea (12)<br>Others (7) |

Source: McCoy et al. (2015)

To understand the export of tuna products from Fiji, some knowledge of the tuna processors is required. Box 8-1 summarises the situation.

**Box 8-1:** Tuna processing in Fiji

The major government investment in the fisheries sector is in the Pacific Fishing Company (PAFCO) in Levuka. PAFCO is a loining and canning plant initially constructed in 1976 as a joint venture with a Japanese partner, C. Itoh (now Itochu). The plant is fully owned by the Fiji government, and since 1999 has produced albacore loins for Bumble Bee Seafoods on a contractual basis. Frozen, cooked albacore loins are produced by PAFCO and shipped to the Bumble Bee canning facility in California. Some canning is also done for the local market. The installed capacity is about 120 mt per day, but it has operated at around 80 mt for the last several years, resulting in total annual throughput of 20,000 to 23,000 mt.

There are six facilities of varying sizes that process and/or semi-process tuna (such as heading and gutting for fresh export) that serve the Fiji-based longline fleet. Most of these facilities have access to products from their own fleets that are owned, chartered or otherwise associated with the enterprise. Two companies – Solander and SeaFresh – export fish, but have processing done by TriPacific Marine Ltd. Fresh yellowfin, bigeye and some albacore are packed and sent to markets in the US, Japan, New Zealand and Australia. One processor, TriPacific – a subsidiary of Foods Pacific, a family-owned food processing business in Suva – does processing and servicing for vessel operators, but does not have vessels of its own. The activities of the newest entrant, Blue Ocean Marine, are reported to be limited to frozen longline bycatch.

Source: McCoy et al. (2015)

## 8.4 Government revenue from fisheries

### Access fees for offshore fishing

The only foreign vessels licensed to fish in Fiji's zone are U.S. purse seiners under the multilateral treaty to which Fiji is a party.[7] Their fishing in the Fiji zone is sporadic and minimal (e.g. 162 t in 2013). As no foreign-based offshore catches in 2020 and 2021 were reported to have been made in the country's EEZ in Fiji's report to the WCPFC Scientific Committee, it is assumed that no foreign-based tuna catches were made during those years.

Ministry of the Economy data (unpublished) show that for the 2018/19 financial year, a total of F$345,928 was received for "Offshore fisheries access fees".

As the total tax and non-tax revenue of the Fiji government was F$3,044,000,000 for 2019, the access fees cited above represent about 0.005% of the total revenue for the year.

[7] Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America.

### Other government revenue from fisheries

Government revenue from fisheries is collected at both the national and the divisional/provincial levels. Fiji's Schedule 7 of Offshore Fisheries Management Regulations 2014 specifies the fees to be charged for 71 different items, including the Fiji vessel management and monitoring fee, observer levy, export permit, recreational fishing license fee and transshipment fee.

Ministry of the Economy data (unpublished) show that for the 2018/19 financial year, a total of F$4,288,961 was received by the Fiji government from 13 types of fees charged by the Ministry of Fisheries. As F$884,441 was received for "Offshore fisheries access fees", the balance (i.e. non-access fees) was F$3,404,520.

## 8.5 Fisheries-related employment

Starkhouse (2009) appears to be the most methodical study of employment in Fiji's coastal fisheries in the last two decades. That study estimates the number of (a) subsistence fishers in the country to be about 23,000, (b) full-time artisanal fishers to be about 5,000 and (c) part-time artisanal fishers to be 12,000. By contrast, an Asian Development Bank (ADB) study (Hand et al. 2005) estimated the number of subsistence fishers in Fiji to be "3,000 full-time equivalents" and the number employed in offshore fishing to be "510 full-time equivalents". If some assumptions are made about the data from the two sources (i.e. 3 part-time artisanal fishers equals one full-time equivalent, and 23,000 part-time subsistence fishers equals 3,000 full-time equivalents), then there are (full-time equivalents) 9,000 artisanal coastal fishers and 3,000 coastal subsistence fishers. These 12,000 people employed in coastal fishing represent over 3 times the number employed in offshore fishing and associated processing and 1.3% of the total population.

A HIES was carried out in Fiji in 2019/20. Although a summary report is available (FBOS 2021b), a detailed analysis of the data enabling fisheries information to be extracted was not available at the time of writing the present report.

In the 2015/16 Employment and Unemployment Survey (FBOS 2021a), all mentions of fisheries employment are combined with agriculture and forestry. For example, the report states "Agriculture, Forestry and Fisheries – 45,482 money earners accounting for 17.3% of the total". Similarly, in the Annual Paid Employment Statistics 2019 (FBOS 2022a), fisheries employment is aggregated with agriculture and forestry.

An agriculture census was carried out in Fiji in 2020 (MOA 2021). Although there is considerable fisheries information in the report of the census, most of the results relevant to fisheries are reported for "agricultural households"[8] rather than for all households. For example:

- During the reference period, a total of 70,991 agricultural households were reported in the country, of which 29,450 households, constituting 41.5%, were involved in fishing activities.
- The number of agricultural household members who consider fishing as their main or secondary activity was 4,513 people (3,007 males and 1,506 females).

The topic of gender in fisheries is relatively well-studied in Fiji. The Pacific Community (SPC 2019b) provides information on gender roles in the major small-scale fishing activities (Table 8-12), and Thomas et al. (2021) report on the results of a study examining the role of indigenous Fijian women in small-scale fisheries in Fiji.

**Table 8-12:** Fisheries-related gender roles

| Activity | Mainly men's role | Mainly women's role | Men and women both |
|---|---|---|---|
| Fishing from vessels outside the reef | X | | |
| Fishing from canoes with lines or nets | X | | |
| Fishing from bridges and promontories with lines | | | X |
| Wading with nets | X | X | |
| Wading with handlines | | X | |
| Reef gleaning for octopus and shellfish | | X | |
| Collecting crabs | | X | |
| Farming tilapia or milkfish – digging ponds, piping water, heavy maintenance, harvesting | X | | |
| Farming tilapia or milkfish – pond cleaning and maintenance, harvesting, processing | | X | |
| Prawn farming | | | X |
| Collection of speciality products such as beche-de-mer and trochus | | | X |
| Raising pearl spats and pearl farm maintenance | | X | |
| Post-harvest processing of fisheries products | | | X |

Source: SPC 2018

8 An "agricultural household" is defined as a household where the main economic activity identified is farming.

**Box 8-2:** The role of indigenous women in small-scale fisheries in Fiji

The results of household and focus group surveys to examine the role of indigenous Fijian women showed that most women had multiple motivations for fishing, although subsistence was the most common reason (99%). For 43% of women, fishing was also a source of income. However, 'cultural events' was actually the second most common motivation (64%) for women to go fishing, followed by social activities (48%). Only 3% of women mentioned fishing for church obligations. We asked women to select their primary fishing motivation (i.e. only one option allowed), for which 83% percent chose food to feed their families. Income generation was second, at 14%. Only 3% of respondents listed social, cultural or church events as their primary motivation. During the focus group discussions, we asked women if their village benefited from women fishing, to which 95% of the focus groups responded in the affirmative. Only a few villages answered the follow up question on why or why not; but for those that did, a source of food and/or income were cited as the benefit(s) of women fishing. Finally, 59% of the women said that at least one male member of their household also fished. We asked women fishers to estimate the proportion of their catch used for three purposes: food, sale, and to give away. If applicable, the woman then answered the same question about the catch from the male fisher(s) in her household. Overall, responses showed that on average women estimated more of their catch (70% vs. 62%) was for subsistence when compared to men. Women also sold less (37% vs. 43%) compared to men. There was no significant difference between women and men in terms of the percentage (19%) of catch given away.

Source: Thomas et al. (2021)

An FFA programme, the Economic Indicators Project, collects data on tuna-related employment in standardised form. Ruaia et al. (2020) contains information from the FFA programme on the employment of people from Fiji in the tuna industry (Table 8-13). "Employment" in that study encompasses the harvest, processing and ancillary services sectors, observers and government employees (the artisanal sector is not included). The table shows a total of 3,821 Fijians were employed in the tuna industry in 2019. Total employment related to tuna fisheries in FFA member countries for 2019 was estimated at 23,861 people, an increase of 9% on the previous year and 24% since 2015.

**Table 8-13:** Employment in Fiji's tuna industry

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of people employed | 991 | 1,493 | 1,724 | 2,850 | 2,984 | 3,658 | 4,595 | 4,242 | 4,149 | 3,821 |

Source: Ruaia et al. (2020)

## 8.6 Levels of fishery resource consumption

The following summarise some of the results of earlier studies on fish consumption in Fiji:

- The Fisheries Division (2000) gives per capita seafood consumption based on the official production data divided by the Fiji population. The results show that in 1999 the rate was 56.0 kg, of which subsistence fishery provided 46%.
- Preston (2000) used 1995 Food and Agriculture Organization (FAO) production, import and export information to estimate a per capita supply of fish in Fiji of 50.7 kg per year.
- The results of the 2004 Fiji National Nutrition Survey (NFNC 2007) provide more insight into the frequency of seafood consumption, as opposed to the level of seafood consumption. Daily consumption of fresh fish in indigenous Fijian households was 23.4%. Canned fish was eaten by only 8.3% of people on a daily basis. In Indo-Fijian households, only 2.4% reported eating fresh fish, and 1.9% ate canned fish on a daily basis.

Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate fish consumption based on both subsistence and cash acquisitions. For Fiji, the per capita fish consumption (whole weight equivalent) was 15.0 kg per capita per year in urban areas (fresh fish made up 45% of this amount) and 25.3 kg per capita per year in rural areas (66% fresh fish).

The SPC Pacific Regional Oceanic and Coastal Fisheries (PROCFish) project carried out survey work at Dromuna, Muaivuso, Mali and Lakeba (Friedman et al. 2010). That work included estimations of per capita fish consumption. The results (Table 8-14) indicate a very high consumption of fresh fish at the four sites. Those sites should not be considered representative of all locations in Fiji as they are coastal areas known to be active in fisheries.

**Table 8-14:** Fishery product consumption at PROCFish sites (kg/person/year)

| Village | Fresh fish consumption | Invertebrate consumption | Canned fish consumption |
|---|---|---|---|
| Dromuna | 74.0 | 4.4 | 2.9 |
| Muaivuso | 68.0 | 10.0 | 3.0 |
| Mali | 81.0 | 13.1 | 1.8 |
| Lakeba | 73.0 | 10.5 | 1.8 |
| Average across the 4 sites | 74.0 | 9.5 | 2.4 |

Source: Friedman et al. (2010)

Gillett (2019) is a study of the domestic fish trade in Fiji. It states that longlining in the Fiji zone produces tuna (mainly for export) and other species (mainly for domestic consumption). In the Fiji Government submissions to the Scientific Committee of the Western and Central Pacific Fish Commission (OFD 2017, 2018), the following is stated:

- For 2016, a total of 14,527 tonnes of tuna and other species were landed, of which 9,622 tonnes of tuna were processed and exported, while 4,906 tonnes were sold locally.
- For 2017, a total of 17,149 tonnes of tuna and other species were landed, of which 13,852 tonnes of tuna were processed and exported, while 3,297 tonnes were sold locally.

If it is assumed that most, if not all, of the domestic longline sales are to consumers in the Suva area. The amount of longline fish equates to 17.8 kg per year for the 185,000 consumers in the greater Suva area in 2017.

In 2019/20 a HIES was carried out in Fiji. Detailed results of the HIES that would enable estimates of per capita fish consumption have not yet been released by the Fiji Bureau of Statistics.

Thomas et al. (2021) gives the results of a study examining the role of indigenous Fijian women in small-scale fisheries in Fiji. The study has a component on fish consumption:

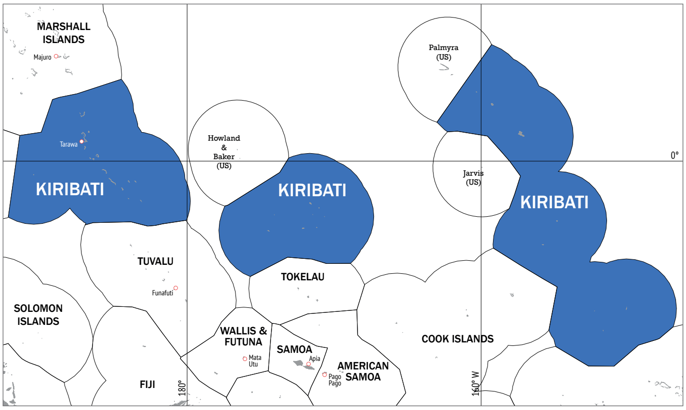
> Women fishers were asked about the types of protein (i.e., fresh fish, canned fish, invertebrates [e.g. crabs, shellfish], dahl [lentils], canned meat, pork, chicken, and beef) they served in their main meals over the previous week. Fresh fish was the most commonly consumed protein, eaten on average three times a week, and two times a week was the most common frequency. Ninety-five percent of the women fishers' households had consumed fresh fish up to seven times in the past week, or an average of once a day. However, 13% of the households had eaten no fresh fish during the prior week. Canned fish was the second most common (1.3 times/week) source of protein, followed by dahl (1 time/week). Invertebrates (0.9 times/week), chicken (0.7 times/week), pork (0.3 times/week), canned meat (0.3 times/week) and beef (0.2 times/week) were all eaten less.

## 8.7 Exchange rates

The average yearly exchange rates (Fiji dollar to the US dollar) used in this book are as follows:

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|
| 1.98 | 2.13 | 2.13 | 2.06 | 2.13 | 2.16 | 2.05 | 2.12 | 2.28 |

# 9 Kiribati




## 9.1 Volumes and values of fish harvests in Kiribati

### Coastal commercial catches in Kiribati

The following are the major historical attempts to consolidate information on coastal fisheries production in Kiribati in recent years:

- Dalzell et al. (1996) used data from a 1991 nutritional survey to estimate coastal commercial fisheries production of 3,240 tonnes (t), worth US$4.8 million, and subsistence fisheries production of 9,084 t, worth US$13.4 million.
- Gillett and Lightfoot (2001) considered the Dalzell estimate, studies by the Fisheries Division and other agencies, and the opinions of fisheries specialists with substantial experience in Kiribati. They subsequently ventured an estimate of coastal commercial fisheries production of 6,000 t (worth US$9.8 million) and subsistence fisheries production of 10,000 t (worth US$12.2 million).
- Annual reports of the Fisheries Division (2003–2006) contain much valuable information, but it appears that the only attempt to consolidate fisheries production information is in the 2003 Fisheries Division Annual Report, which states: "The weekly fish production for all Islands in the Gilbert group is 489.5 tonnes per week. This shows a decrease of 38% from last year's figure of 791.7 tonnes per week." (Fisheries Division 2004).
- Preston (2008) divides coastal fisheries production into two components: household fishery catch and export fishery catch. An annual household fishery catch of 20,000 t is estimated. For export fish production, because

the available statistics are often incomplete and inconsistent, Preston does not make an overall estimate, but rather just presents the available data.

- Gillett (2009a) (a) uses the Preston (2008) figures, (b) estimates fisheries production for export, and (c) considers the results of a short, small-scale tuna fishing survey on South Tarawa. Overall, Gillett (2009a) estimated that in the mid-2000s, coastal commercial production was about 7,400 t (worth about A$22 million to fishers), and subsistence production was about 13,700 t (worth about A$34 million to fishers).
- Gillett (2016) considered the results of a new household income and expenditure survey (HIES), the results of a short study of tuna trolling on South Tarawa, the expanded ice facilities in the outer islands, and the results of the Marine and Coastal Biodiversity in Pacific Island Countries (MACBIO) study (Box 9-1). The latter had estimates of volumes and values for coastal commercial but for several reasons, those were considered too low by Gillett (2016), who then considered changes in boat numbers between censuses, changes in harvests of ark shell (*Anadara* sp., "te bun"), leakages from tuna transshipment operations and exports of reef fish to China. The study concluded the 2014 total coastal fishery production was 19,000 t (worth A$38,697,000 to fishers), comprising coastal commercial fishery production of 7,600 t (worth A$18,861,000) and coastal subsistence fishery production of 11,400 t (worth A$19,836,000).

**Box 9-1:** The fishery production estimates from the MACBIO survey

Two sources of data were used to estimate the value of subsistence fishing in Kiribati: Ministry of Fisheries data and the 2006 Household Income and Expenditure Survey (HIES). The economic value of subsistence fishing estimated using these two sources differed significantly, probably because the scope, coverage and timing of the data sources are different. The gross value of subsistence fishing, estimated from multiple data sources, was between A$3.7 and A$38.5 million per year. The lower estimate of A$3.7 million per year is unlikely to be a true reflection of actual subsistence value. Instead, the Ministry of Fisheries estimate of net value of A$ 9.6–19.2 million per year is used. Subsistence fishing costs are minimal, so the value-added was similar to the gross value, approximately A$9.6–34.5 million per year. The analysis of commercial fishing was done for two categories: small-scale (household-level) commercial fishing and industrial fishing. The economic value of commercial fishing was estimated from various data sources. The gross value of small-scale commercial fishing ranged from A$7 million to A$25 million per year. This estimate included small-scale tuna fishing, with a gross value of about A$4 million per year. Small-scale inshore commercial fishers generally use outboard engines therefore their operational costs are higher than those of subsistence fishers. In this analysis, fuel costs were assumed to be 60% of the gross output, leaving a value-added of A$2.8–10 million.

Source: Rouatu et al. (2015)

There are limited sources of information on the changes in coastal fisheries production in Kiribati in the period 2014–2021. There is an Agriculture and Fisheries Report based on the 2020 census, the 2019/20 HIES report, information on the change in population, reports on the impact of Covid on fisheries in Kiribati, and information on changes in the production of some important fisheries. Although the Ministry of Fisheries and Marine Resources Development (MFMRD) carried out field work on several atolls to assess the recent change in marine resources (e.g. Nonouti, Kuria and Abemama), it was not possible to apply the results to determine changes in coastal fisheries production.

The Agriculture and Fisheries Report (Anon. 2021a) has information enabling a comparison of fisheries activities between the 2020 census and the 2015 census. It states:

- In 2015, 69% of all households reported undertaking fishing activities, while in 2020 this had dropped to 47% of all households. The proportion of urban island households engaged in fishing fell from 57% in 2015 to 33% in 2020, while rural island fishing households fell from 80% in 2015 to 63% in 2020.
- While the total number of households across Kiribati increased by 15%, the number of fishing households reduced by 21% nationally, including decreases of 30% on the urban islands and 14% on the rural islands.
- In 2015, 75% of households reported that their main purpose for fishing was home consumption. This reduced to 69% of households in 2020, with the main reductions occurring on the urban islands (from 81% in 2015 down to 73% in 2020).

The 2019/20 HIES (NSO 2021a) indicates that 44% of households in Kiribati participate in fisheries activities. The 2006 HIES (Tiroa 2006) does not contain comparable participation information.

Data from the the Pacfic Community (SPC)/Statistics for Development Division (SDD) website shows that the population of Kiribati increased 12% between 2014 and 2021.

During the Covid period, there was an initial lockdown, which included fishing activities, starting on January 24, 2022. A few days later it was relaxed so that fishing was allowed from 6 am to 2 pm. In mid-June 2022 Covid-related restrictions on fishing stopped. A major impact of Covid on the fish trade in Tarawa is that sales of fish rejected during transshipment stopped completely, resulting in increased production from the Tarawa skiff troll fleet. In general, aside from the Tarawa troll fleet, there was a reduced amount of coastal commercial fishing activity and more purchasing of food from stores during the Covid period – but this was after 2021, the focal year of the present study.

There is some information available on changes in the production of some important fisheries. The catch of ark shell (*Anadara sp*., “te bun”) plummeted in recent years in both Tarawa and atolls that supply Tarawa (R. Kienene, per. com. January 2023).

In 2021 prices paid to fishers ranged from $A1.80 to A$2.00 per pound on Tarawa (A$3.97 to A$4.41 per kg) (M. Savins and R. Kienene, per. com. January 2023).

The above information is inadequate for revising the volume and value of the coastal commercial catches given in Gillett (2016). It does suggest larger population but less fishing activity and some shift towards commercial fishing. For the purposes of the present study, the total 2021 coastal commercial fishery production will be taken to be 8,000 t, worth A$31 million to fishers.

### Coastal subsistence catches

Following the approach above, it is estimated that the production from coastal subsistence fisheries in Kiribati in 2021 was 11,000 t, worth A$30 million to fishers.

### Locally based offshore catches

The primary source of information on offshores catches for most countries covered by the present study is the reports by the countries to the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC). The Kiribati report to WCPFC states that in 2021 there were 34 longliners (Kiribati Fish Limited Company [KFL] chartered vessels) and 26 purse seiners (joint venture and charter arrangements) in the “flag state reporting” section of the report, hence they are considered to be registered in Kiribati and referred to in the text as “Kiribati longline” and “Kiribati purse seine” vessels.

To determine the “locally based offshore catches”, some assumptions are required. The Kiribati paper to WCPFC indicates that the longliners that have access to the Kiribati exclusive economic zone (EEZ) are either owned or chartered by joint venture companies KFL and Kiritimati Island Fish Limited (KIFL). From this it is assumed that all longliners fishing in the Kiribati zone is supplying the KFL processing plant in Betio, Tarawa, and therefore locally based. Secondly, it is assumed that in the “catch by fleet” section of the Forum Fisheries Agency (FFA) spreadsheet of values and volumes of tuna catch (FFA

2022b), the Kiribati longline fleet consists of the longliners that are either owned or chartered by joint venture companies (i.e. the vessels that supply the KFL processing plant). It is further assumed that due to logistical requirements, there are no locally based purse seiners.

Following from these assumptions, in 2021 the tuna catch by the locally based longliners was 2,686 t, with an in-zone value of A$17.6 million (Table 9-1).

**Table 9-1:** Locally based offshore catches in the waters of Kiribati

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Volume (t) | 1,393 | 998 | 3,429 | 4,768 | 2,686 |
| Delivered value (US$) | 7,411,113 | 6,844,765 | 21,406,374 | 32,539,382 | 16,965,033 |
| In-zone value (US$) | 5,558,335 | 5,133,574 | 16,054,781 | 24,404,537 | 12,723,775 |
| In-zone value (A$) | 7,170,252 | 7,289,675 | 23,118,884 | 32,213,988 | 17,558,809 |

Source: FFA (2022b), with modifications

Should the three assumptions above be shown to be invalid, the amounts in the table need to be adjusted.

### Foreign-based offshore catches

According to the Kiribati paper to WCPFC, all longline catches in the Kiribati zone are by the Kiribati longline fleet, so all catches by foreign-based vessels in the Kiribati zone are by purse seiners. From the FFA spreadsheet of values and volumes of tuna catch (FFA 2022b), the purse seine catch in the Kiribati zone can be obtained (Table 9-2).

**Table 9-2:** Catches by foreign-based vessels in the Kiribati zone

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Volume (t) | 379,799 | 397,399 | 681,914 | 346,110 | 349,345 |
| Delivered value (US$) | 703,157,769 | 670,046,888 | 993,087,259 | 488,594,500 | 505,667,044 |
| In-zone value (US$) | 627,197,969 | 590,567,088 | 856,704,459 | 419,372,500 | 435,798,044 |
| In-zone value (A$) | 809,085,380 | 838,605,265 | 1,233,654,420 | 533,571,700 | 601,401,300 |

Source: FFA (20222), with modifications

### Freshwater catches

There are no freshwater fisheries in Kiribati.

## Aquaculture harvests

A recent regional review of aquaculture (IAS 2022) commented on aquaculture in Kiribati:

- Current species cultivated commercially: Giant clam produced by one commercial hatchery (Atoll Beauties). No flights recently so no exports. Previously exported clams to RMI and elsewhere to international markets.
- Current species used for food security & small-scale community-based production: Sea cucumber for restocking and also community farmers. Done in the hatchery but some problems so no real progress on the ground so far, though the hatchery process is now known – small scale pilot projects. Giant clams for restocking – very small scale. The Ambo hatchery is working with a monthly spawning of milkfish. Fingerlings sent to the outer islands. Also supplying a newly installed cage farm in Tarawa lagoon. Also exported milkfish fry to Nauru in the past – biosecurity issues are hindering further development. Temaiko ponds are undergoing rehabilitation and will be restocked with milkfish in the near future. World Bank gives 3,652 tonnes as production for 2018, presumably this was mostly seaweed.
- Other species attempted or planned: Brine shrimp, mullet, black lip pearl oyster, seaweed (now abandoned due to no buyers and lack of interest after early successes). Sponge, corals, mangrove crab, sea grapes – all for the future.

Information on aquaculture production in Kiribati is scarce. That which is available shows:

- Customs Department data indicate that the last export of seaweed was in 2017, when 96 t was shipped.
- MFMRD unpublished data show that in 2021 milkfish production was 668,544 fry, and sandfish production was 821 fry.
- The Convention on the International Trade of Endangered Species (CITES) database shows that the last year that giant clams was exported was 2019, when 2,790 live giant clams were shipped to the United States and Germany.
- The major private sector fish farmer in Kiribati indicated that in 2021 there was zero aquaculture production for export, and the only significant aquaculture production for domestic use was milkfish from Christmas Island that was frozen and shipped to Tarawa for sale. There was no production of giant clams for restocking purposes (M. Savins, per. com. February 2023).

From the above it is evident that in 2021 aquaculture exports were zero, but there was some culturing of milkfish for local use. For the purposes of the present study, the 2021 aquaculture production of Kiribati will be taken to be 2 t, worth A$10,000 at the farm gate.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values[1] of the fishery and aquaculture harvests in 2021 can be made (Table 9-3).

**Table 9-3:** Annual fisheries and aquaculture harvest in Kiribati in 2021

| Harvest sector | Volume (t) | Value (A$) |
|---|---|---|
| Coastal commercial | 8,000 | 31,000,000 |
| Coastal subsistence | 11,000 | 30,000,000 |
| Offshore locally based | 2,686 | 17,558,809 |
| Offshore foreign-based | 349,345 | 601,401,300 |
| Freshwater | 0 | 0 |
| Aquaculture | 2 | 10,000 |
| **Total** | **371,033** | **679,970,109** |

The fairly weak factual basis for all of the above estimates should be recognised.

Figures 9-1 and 9-2 show the volumes and values of Kiribati fisheries production in 2021.

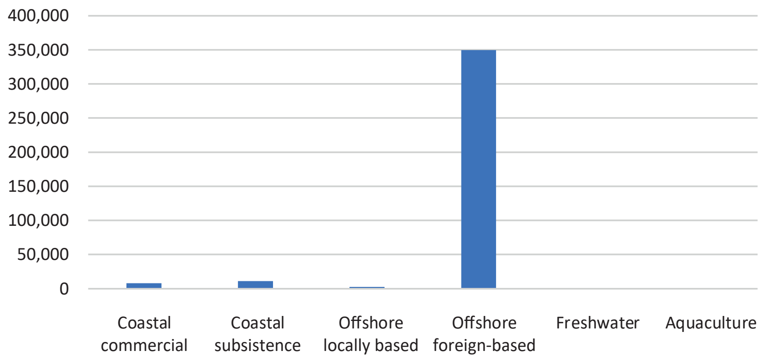



**Figure 9-1:** Kiribati fisheries production in 2021 by volume (t)

[1] The values in the table are dockside/farm gate prices, except in the case of offshore, foreign-based fishing, where the value in local waters (overseas market prices less imputed transshipment costs) is given.

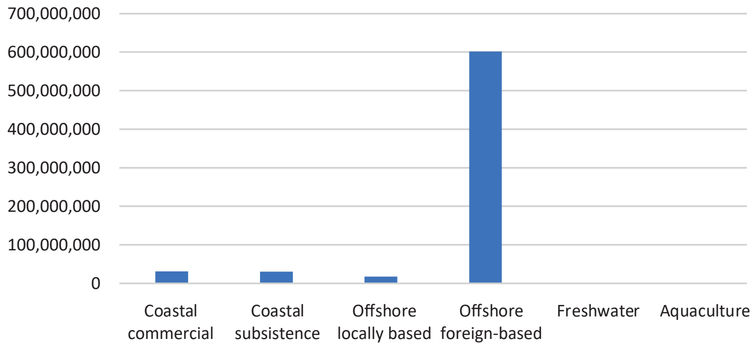



**Figure 9-2:** Kiribati fisheries production in 2021 by value (A$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2106) on 2014, and the present study on 2021. Fishery production levels for Kiribati from those four studies are presented in Table 9-4.[2]

[2] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

**Table 9-4:** Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (A$) |
|---|---|---|---|
| Coastal commercial | 1999 | 6,000 | 9,780,000 |
| | 2007 | 7,000 | 22,000,000 |
| | 2014 | 7,600 | 18,861,000 |
| | 2021 | 8,000 | 31,000,000 |
| Coastal subsistence | 1999 | 10,000 | 12,230,000 |
| | 2007 | 13,700 | 34,000,000 |
| | 2014 | 11,400 | 19,836,000 |
| | 2021 | 11,000 | 30,000,000 |
| Offshore locally based | 1999 | 0 | 0 |
| | 2007 | 0 | 0 |
| | 2014 | 510 | 4,400,000 |
| | 2021 | 2,686 | 17,558,809 |
| Offshore foreign-based | 1999 | 132,000 | 205,000,000 |
| | 2007 | 163,215 | 234,491,135 |
| | 2014 | 701,067 | 1,355,549,878 |
| | 2021 | 349,345 | 601,401,300 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2016 | 0 | 0 |
| | 2021 | 0 | 0 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 143 t and 100 pcs | 90,000 |
| | 2014 | 255 t and 8,642 pcs | 289,757 |
| | 2021 | 2 | 10,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies represents a real change in production in some cases, but this can also represent a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for coastal commercial and coastal subsistence change significantly between the years, but some of that change is due to the way in which the production was estimated. In contrast, changes in production figures in the table for offshore fisheries (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 9.2 Contribution of fishing to GDP

### Current official contribution

The official contribution of fishing to GDP is given in Table 9-5.

**Table 9-5:** Fishing contribution to GDP (A$ thousands)

| | 2017 | 2018 r | 2019 r | 2020 r | 2021 p |
|---|---|---|---|---|---|
| Informal sector fishing for cash sales | 5,678 | 6,183 | 5,924 | 6,403 | 5,959 |
| Seaweed growers | 75 | 75 | 75 | 75 | 75 |
| Informal sector fishing for subsistence | 9,464 | 10,305 | 9,874 | 10,672 | 9,932 |
| Formal sector fishing | 4,973 | 10,229 | 9,306 | 6,223 | 8,226 |
| Total fishing contribution | 22,207 | 26,792 | 25,179 | 23,373 | 24,192 |
| Kiribati GDP at market prices | 245,532 | 262,640 | 252,344 | 258,139 | 302,793 |
| Fishing as a % of GDP | 9.0% | 10.2% | 10.0% | 9.1% | 8.0% |

Source: NSO (unpublished data); r = revised; p = provisional

### Method used to calculate the official fishing contribution to GDP

Only limited information is available on the method used by the National Statistics Office (NSO) to estimate the fishing contribution to GDP, and the NSO website was not functional during late 2022 and early 2023. HIES data are used to determine the value added of the informal fishing sector (L. Moaniba, per. com. January 2023).

### Alternative estimate of fishing contribution to GDP

Table 9-6 (below) represents an alternative to the official method of estimating fishing contribution to GDP in Kiribati. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 9-1 above (summarised in Table 9-3) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

To obtain the alternative estimate of fishing contribution to the Kiribati GDP requires some assumptions. It is assumed that (1) the Asian vessels occasionally supplying the KFL processing plant in Betio are not part of the Kiribati economy (i.e. their centre of economic operations is not in Kiribati), and (2) the three longline vessels operated by CPPL (a state-owned enterprise) are part of the Kiribati economy.

Catches by CPPL longliners in 2021 were 20.16 t (MFMRD unpublished data). Using price data from FFA (FFA 2022b), the delivered value of that catch is estimated to be US$127,332, or an in-zone value of US$95,499 (A$131,789).

It is not intended that the approach in Table 9-6 below replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

**Table 9-6:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (A$) | VAR | Value added (A$) |
|---|---|---|---|
| Coastal commercial | 31,000,000 | 0.65 | 20,150,000 |
| Coastal subsistence | 30,000,000 | 0.90 | 27,000,000 |
| Offshore locally based | 131,789 | 0.20 | 26,358 |
| Freshwater | 0 | --- | 0 |
| Aquaculture | 10,000 | 0.72 | 7,200 |
| **Total** | **61,141,789** | ---- | **47,183,558** |

The fishing contribution to GDP – A$47.2 million – is 15.6% of the A$302.8 million GDP of Kiribati in 2021.

This alternative fishing contribution is much greater than the official fishing contribution. The coastal commercial (A$20 million) and coastal subsistence (A$27 million) components of the alternative contribution are much greater than the informal sector fishing for cash sales (A$6 million) and the informal sector fishing for subsistence (A$10 million) of the official contribution.

## 9.3 Exports of fishery production

The fishery exports of Kiribati from Customs Department data, kindly provided by SPC/SDD, are given in Table 9-7.

**Table 9-7:** Fishery exports of Kiribati (thousands of A$)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Fish | 4,395 | 4,704 | 9,882 | 6,633 | 3,537 |
| Seaweed | 96 | 0 | 0 | 0 | 0 |
| Total fishery exports | 4,491 | 4,704 | 9,882 | 6,633 | 3,537 |
| Total direct exports | 15,935 | 8,915 | 12,901 | 11,359 | 11,512 |
| Fishery exports as % of all direct exports | 28.2% | 52.8% | 76.6% | 58.4% | 30.7% |

Source: SPC/SCC (unpublished data)

For some years, the exports listed in the table could be an underestimate. The "fish" in the table are actually "fresh, chilled and frozen fish, including fillets" and therefore do not include aquarium products ("pet fish"). In some years, there have been substantial exports of live aquarium fish (but not in 2021 because of the lack of air service). An SPC regional study of aquarium trade (Gillett 2020) shows that in 2018, 105,311 live fish, worth US$1,007,850 (A$1,431,147), was shipped from Christmas Island to Hawaii. In addition, the table above does not include the giant clam exports of Kiribati. In a section above it is stated that in 2019, 2,790 live giant clams were shipped to the United States and Germany.

## 9.4 Government revenue from fisheries

### Access fees for offshore fishing

The latest "Fishing License Revenues in Kiribati" (MFMRD 2019) gives the fishing license revenue for 2017 as A$169.0 million, for 2016 as A$143.3 million and for 2015 as A$197.8 million.

The "fishing license revenue" is given in the 2023 Recurrent Budget (NEPO 2022), which shows that in 2021 it was A$161,445,289.

With the "total government revenue" of A$246,458,807 (NEPO 2022), the "fishing license revenue" equates to 65.5% of "total government revenue".

In a Kiribati economic survey (Webb 2020), the impact of fishing license fees on the national budget is described (Box 9-2).

**Box 9-2:** The impact of fishing license fees on the national budget

The improved fishing revenue was responsible for a significant turnaround in national finances. Prior to 2012, the Budget was regularly in deficit, and there was an ongoing reliance on drawdowns on Kiribati's sovereign wealth fund, the Revenue Equalisation Revenue Fund or RERF. However, from 2013, there were significant surpluses and contributions to the RERF. Examination of the government revenue estimates between 2012 and 2015 reveals a strong conservative bias in fishing license forecasts, with actual revenue exceeding estimates by $318.4 million over this period. By contrast, budget documents estimated that the net financing need was $91.8 million in deficits across the four years. As a result, there was a significant surplus of cash flowing onto the government balance sheet. Non-RERF cash balances increased from $11.3 million in January 2013 to an estimated $173.5 million by the end of 2018 (Ministry of Finance and Economic Development [MFED], 2018), and the RERF balance grew from $613.9 million to $994.4 million over that same period—just short of the government's $1 billion target. State-owned enterprise commercial debts with ANZ were also eliminated within this timeframe, and the government invested $10 million in a land purchase in Fiji.

## Other government revenue from fisheries

The 2023 Recurrent Budget (NEPO 2022) gives the non-access revenue for 2021 as:

- Fish transshipment fees: A$7,481,672
- Local fishing: A$1,999
- Fish and fish poster sales: A$984
- Vessel and equipment hire: A$3,591
- EEZ chart sales: A$3,385
- Marine Scientific research: A$5,269

## 9.5 Fisheries-related employment

The 2019/20 HIES (NSO 2021a) contains a wealth of information on participation in fisheries. Nationally, around 44% of all households participate in fisheries activities. Table 9-8 gives the number of people participating in the various types of fishing. Females were almost exclusively fishing invertebrates (82%).

**Table 9-8:** The number of people aged 5 and above participating in various types of fishing

| | Net | Handline | Trolling | Night spear | Day spear | Gleaning | Traps | Dive | Scuba | Other |
|---|---|---|---|---|---|---|---|---|---|---|
| Strata | | | | | | | | | | |
| South Tarawa | 1,226 | 451 | 195 | 130 | 77 | 332 | 22 | 37 | 0 | 514 |
| Northern | 1,399 | 463 | 150 | 65 | 102 | 580 | 0 | 63 | 17 | 321 |
| Central | 879 | 170 | 92 | 10 | 127 | 366 | 6 | 19 | 13 | 289 |
| Southern | 1,366 | 202 | 169 | 73 | 119 | 478 | 80 | 64 | 7 | 370 |
| Line Is. & Phoenix | 519 | 88 | 18 | 5 | 13 | 11 | 0 | 0 | 9 | 39 |
| Urban/Rural | | | | | | | | | | |
| Urban | 1,226 | 451 | 195 | 130 | 77 | 332 | 22 | 37 | 0 | 514 |
| Rural | 4,162 | 923 | 429 | 154 | 361 | 1,435 | 87 | 145 | 46 | 1,019 |
| Sex | | | | | | | | | | |
| Male | 5,254 | 1,353 | 610 | 284 | 438 | 673 | 109 | 182 | 46 | 1,277 |
| Female | 135 | 21 | 14 | 0 | 0 | 1,094 | 0 | 0 | 0 | 256 |
| Age group | | | | | | | | | | |
| 5–14 years | 193 | 155 | 0 | 0 | 14 | 155 | 0 | 0 | 0 | 129 |
| 15–17 years | 310 | 40 | 0 | 17 | 0 | 87 | 0 | 0 | 0 | 92 |
| 18–59 years | 4,668 | 1,088 | 616 | 267 | 424 | 1,446 | 96 | 182 | 46 | 1,268 |
| 60+ years | 217 | 92 | 8 | 0 | 0 | 78 | 13 | 0 | 0 | 44 |
| Disability status | | | | | | | | | | |
| With disability | 161 | 39 | 4 | 0 | 0 | 60 | 0 | 0 | 0 | 23 |
| Without disability | 5,227 | 1,336 | 619 | 284 | 438 | 1,707 | 109 | 182 | 46 | 1,511 |

Source: NSO (2021a)

The Kiribati Agriculture and Fisheries Report (Anon. 2021a) was prepared from data in the 2020 population and housing census. Similar to the results of the HIES above, this report states that 47% of all Kiribati households participate in fishing. The report breaks down household participation by island, showing a range from 24% on Betio to 90% on South Tabiteuea.

Employment-related data are available in the document "Labour in Kiribati Based on Analysis of the 2019/20 HIES". Unfortunately, most of the results that could be relevant to fisheries are lumped with other sectors to form the category of "Skilled agricultural, forestry & fishery workers". The report does indicate that "working in fishing or gleaning seafood" is the "main activity" for only 0.8% of the working-age population, suggesting that very few people do this type of work as their primary occupation.

The FFA Economic Development Indicators report (Ruaia et al. 2020) provides information on tuna-related employment in Kiribati. It states that in 2019, 1,252 people were employed in the "harvest, processing and ancillary services sectors, observers and government employees (artisanal sector not included)".

Kiribati National Fisheries Policy 2013–2025 (MFMRD 2013) comments on the gender aspects of participation in fisheries (Box 9-3).

**Box 9-3:** Gender aspects of participation in Kiribati fisheries

I-Kiribati have some form of involvement in fishing activities, whether it be artisanal, subsistence, boat-based, shore-based, harvesting, reef gleaning, processing or aquaculture. Because of the danger of handling unfriendly species at sea (sharks, swordfish, etc.) and the risk of going adrift when there is sudden change of weather or breakdown, women are not expected to fish at sea. Traditionally, men have dominated fishing activities at sea while women have been heavily engaged in shore-based harvesting and processing activities. With the commercialisation of the artisanal fishing, especially on South Tarawa, the contribution made by women has increasingly become part of the daily management and running of fish outlets. Today, women are regarded as team players for their major role in the development and support of Kiribati fisheries, especially in the marketing and sale of fish. But the development of fisheries in Kiribati (as in some other Pacific Island nations) can bring with it unwanted social problems of significant proportion, especially changes in social behaviour (for example, in relation to alcohol and sex). Of particular concern is the transshipment industry in Tarawa and Kiritimati, which has given rise to increased alcoholism and prostitution in young women, some of whom are between the ages of 15 and 18 years. The periodic reports of social workers, who interviewed young women who often board fishing vessels on transhipment calls (Ainen Matawa and Korekorea), show that the number has increased to a level where it has become a concern to churches and to the government.

## 9.6 Levels of fishery resource consumption

The following summarise some of the earlier studies of fish consumption in Kiribati:

- Nube (1989) reports the Kiribati canned fish imports for 1974–1986, which ranged from 112 to 312 t per year. Using information from the 1985 census, Nube estimated daily per capita fish consumption for the 18 islands in the Gilbert and Line groups as ranging from 0.45 kg in South Tarawa to 2.86 kg in Arorae. Of the 18 islands listed, 11 (61%) have a per capita consumption of fish greater than 1 kg per day (i.e. greater than 365 kg/person/year).
- According to Integrated Marine Management (IMM 1993), the estimated catch in the Gilbert Group of Islands translates to an annual fish supply of 207 kg per capita.
- The World Bank (1995), quoting Food and Agriculture Organization (FAO) sources, stated that: "Per capita supplies [of fish] available for consumption are consequently quite high ranging between 72 and 75 kilograms per year over the last decade."
- Using 1995 FAO production, import and export data, Preston (2000) calculates that the annual per capita supply of seafood is 150 kg.
- The World Bank (2000) indicates that in Kiribati 67% of total animal protein is from seafood.
- The 2003 annual report of the Fisheries Division (Fisheries Division 2004) states: "Results from the fish consumption surveys shows that the estimated fish consumption rate per head per day was 253.4 grams". This equates to per capita consumption of 92.5 kg per year.
- The 2004 SPC Pacific Regional Oceanic and Coastal Fisheries (PROCFish) surveys at Abaiang, Abemama, Kuria and Kiritimati (Awira et al. 2008) gave an average annual per capita consumption of finfish of 106.9 kg, plus 2.57 kg for invertebrates.
- The 2006 annual report of the Fisheries Division (Fisheries Division 2008) states: "an average I-Kiribati consumes 241 g of fish per day (2000 to 2003 estimates: Statistics Unit, Fisheries Division)". This equates to per capita consumption of 87.9 kg per year.
- Data in Sullivan and Ram-Bidesi (2008) indicate an annual tuna catch in South Tarawa of 1,584 t per year. Considering the population of 40,311 in South Tarawa, the apparent annual per capita consumption is about 39 kg of tuna. Their summary statement reports: "What is clear is that (a) fish and fish products remain a very significant part of total animal protein supply in Kiribati and (b) tuna species remain the single most common and important marine resource consumed in Kiribati."

- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. For all of Kiribati, the annual per capita fish consumption (whole weight equivalent) was 62.2 kg, of which 92% was fresh fish. For rural areas, the figure for per capita consumption of fish was 58.0 kg, and for urban areas it was 67.3 kg. However, there is some contention that the 2006 HIES data underestimate fish production and consumption.
- The report of the recent MACBIO study (Rouatu et al. 2015) indicates that the weighted average annual per capita fish consumption in Kiribati is 74 kg. The MACBIO fish consumption figures were extrapolated from data from unpublished Fisheries Department surveys in 2011–2013 at Aranuka, Butaritari, Nikunau, Tamana and Beru. Gillett (2016) presents some arguments about why the 74 kg could be considered too low.
- Gillett (2016) states that rejected fish from transshipment operations produce about 373 t of fish, which equates to an annual per capita consumption of 7.5 kg for the residents of South Tarawa and Betio. Blaha (2021) states that the amounts of rejected fish were about 496 t in 2019 and 179 t in 2020.

The only relatively new information on fish consumption in Kiribati is from a study of food consumption in Kiribati based on analysis of the 2019/20 HIES. It shows that the total per capita consumption of three categories of fish (pelagic, reef, fish not further specified) to be 49.6 kg/year of "edible quantity" and 75.9 kg/year "quantity as purchased".

Several features emerge from the above fish consumption studies:

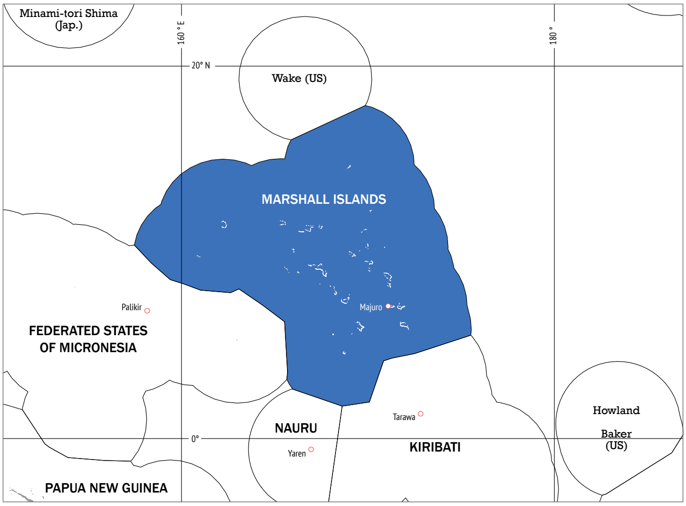
- There is a large amount of variation in annual per capita consumption rates among studies and between islands within studies.
- Some of the earlier studies indicate that Kiribati has the highest rate of fish consumption compared to any country in the world.
- Some of the studies that produced low fish consumption rates could have used the edible food weight of fish instead of the whole fish weight equivalent.

## 9.7 Exchange rates

Kiribati uses the Australian dollar (A$). The average yearly exchange rates (A$ to the US dollar) used in this book are as follows:

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|
| 1.22 | 1.37 | 1.37 | 1.29 | 1.42 | 1.44 | 1.32 | 1.38 | 1.53 |

# 10 Marshall Islands




## 10.1 Volumes and values of fish harvests in Marshall Islands

### Coastal commercial catches in Marshall Islands

The following represent the major historical attempts to consolidate information on coastal fisheries production in Marshall Islands:

- Dalzell et al. (1996) used information from the Forum Fisheries Agency (FFA) fisheries profiles (Smith 1992) and from a nutritional survey in 1990 (Anon. 1991) to estimate coastal commercial fisheries production for the early 1990s of 369 tonnes (t), worth US$714,504, and subsistence production of 2,000 t, worth US$3,103,213.
- Gillett and Lightfoot (2001) considered the Dalzell estimate and seven other sources of information and then proposed coastal commercial fisheries production for the late 1990s of 444 t (worth US$973,000) and subsistence production of 2,800 t (worth US$3,836,000).
- Gillett (2009a) considered the above two estimates and the following more recent information: (a) data on fish purchases in the outer islands by the Marshall Islands Marine Resource Authority (MIMRA), (b) the 2002 household income and expenditure survey (HIES), (c) Overseas Fisheries Cooperation Foundation (OFCF) fishery surveys, and (d) data on the exports of products from coastal commercial fisheries. The study

estimated that commercial fisheries production in Marshall Islands in the mid-2000s was about 950 t, worth US$2.9 million. Commercial was about 25% of all coastal fisheries production (i.e. subsistence fisheries production in the countries was judged to be about 2,800 t).

- A study in 2010 (Echigo 2010) estimated coastal fisheries production in Marshall Islands. The following data were considered: (a) 2009 catch data from four atolls at different levels of development, (b) Majuro and Arno catch data 2002–2006, (c) estimated total catch from Kwajalein Atoll, (d) MIMRA fish market buying data for 2008 and 2009, and (e) population data from the 1999 census. The Echigo study did not include exported fishery products such as aquarium fish, beche-de-mer and trochus (F. Edwards, per. com. September 2015). It is assumed that the total coastal fisheries production in the country estimated by the study (about 4,500 t) is comprised of catch used for both subsistence and commercial purposes.
- Gillett (2016) considered recent changes that would affect coastal fisheries production, including studies that show overexploitation of resources, an increase in fish trade between the outer islands and Majuro, an increase in the population of the country, and an increase in the aquarium trade. Considering those changes and according moderately high credibility to the Echigo study (2010), a crude estimate of the total coastal fisheries production in Marshall Islands in 2014 was made: 4,500 t, of which the commercial fisheries component is 1,500 t, worth about US$4,350,000.

Since the 2016 study mentioned above, there have been many factors affecting the production of coastal fisheries, of which Covid was quite significant. Although international borders were closed in March 2020, a dengue epidemic just prior to the Covid period restricted internal transport in Marshall Islands. MIMRA fish purchases in the outer islands slowed down as the vessels were being used for other purposes. While public sector jobs expanded during the Covid period, those in the private sector contracted by 4%, with 257 jobs lost (Graduate School 2021b). Overall, there were substantially more barriers to the marketing of fish, and it is likely that subsistence fishing increased before and during the Covid period. When the internal Covid-related transport restrictions were relaxed, this did not lead to an immediate increase in fish trade because the MIMRA transport vessels suffered problems and were non-operational starting in August 2021 (G. Joseph, per. com. November 2022).

According to MIMRA staff, other recent shocks to coastal commercial fishing were the movement of people away from the outer islands, the spikes in fuel costs, and during the Covid period, the collapse of the “cooler trade” of shipping fish to Hawaii as personal baggage on passenger flights.

A few years ago, there was a study in which the marine fisheries catches of Marshall Islands were "reconstructed" using methodology that has been applied to several other Pacific Island countries. The study concluded that trends in small-scale fisheries in Marshall Islands have changed over time, with a progressive increase in catches from 1950 to the early 1990s, followed by stabilisation of total small-scale catches at around 4,500 t per year. The artisanal component reached approximately 1,700 t per year in 2017, while catches of the subsistence sector increased from 1,000 t per year in 1950 to 3,200 t per year in 1990 and remained relatively constant at just over 3,300 t per year between 1990 and 2008. From 2009 onward, reconstructed catches by this sector declined by 2% per year on average (Vianna et al. 2020). Those results do not differ much from that reported in Gillett (2016).

Price information was obtained from MIMRA staff (Majuro prices) and from the 2021 MIMRA annual report (outer island prices). For the purposes of the present study, a national price to fishers of US$1.30 per pound (US$2.87 per kg) is assumed.

The information available is inadequate for making an estimate of the 2021 coastal commercial catch, but it does suggest a Covid-induced decline from that of 2016. A crude approximation of the catch is about 1,200 t. The value of the commercial catch to fishers was about US$3.4 million.

### Coastal subsistence catches

The information available is inadequate for making an estimate of the 2021 coastal commercial catch, but it does suggest some factors that would tend to expand the catches (i.e. Covid) and others that would tend to contract the catches (i.e. out-migration). A crude approximation of the subsistence catch is 3,000 t, worth US$6 million to the fishers.

### Locally based offshore catches

The Marshall Islands paper (MIMRA 2022a) submitted in mid-2022 to the Scientific Committee of the Western and Central Pacific Fisheries Commission states:

> In 2021, there were eleven Marshall Islands-flagged purse seine vessels operating throughout the Western and Central Pacific Ocean. The total catch estimates by the national purse seine fleet in 2021 was 89,434 metric tons. Additionally, retained catch estimates, from twenty-eight chartered longline vessels associated with the domestically-based Marshall Islands Fishing Venture, totaled 1,733 metric tons.

For the purposes of the present study, the vessels mentioned above are considered locally based vessels. This consideration will be re-visited in a section below when deciding whether the vessels are part of the economy of Marshall Islands for GDP purposes. The catches of the locally based vessels are given in Table 10-1.

**Table 10-1:** Catches of the Majuro-based offshore vessels

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Marshall Islands flagged purse seine catch (t) | 72,688 | 95,533 | 81,945 | 89,434 |
| Marshall Islands chartered longline catch (t) | 1,922 | 2890 | 1,599 | 1,733 |

Source: MIMRA (2022a)

Using price information in FFA (2022b) and adjusting for in-zone prices (FFA gives delivered prices), the value to fishers can be determined. The purse seine catch is worth US$110 million, and the longline catch is worth US$11 million.

MIMRA staff indicate that the Covid period had minimal effect on purse seine fishing and a small impact on longline fishing. Transshipment in Majuro lagoon was down 40% due to restrictions on port entry.

## Foreign-based offshore catches

MIMRA (2022a) gives the number of foreign vessels by gear type licensed to fish in the waters of Marshall Islands (Table 10-2).

**Table 10-2:** Foreign-based vessels licensed to fish in the Marshall Islands exclusive economic zone (EEZ)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Longline | 49 | 15 | 41 | 32 | 32 |
| Pole/line | 16 | 11 | 20 | 21 | 25 |
| Purse seine | 192 | 179 | 162 | 190 | 183 |

The catches by foreign-based offshore vessels in the waters of Marshall Islands can be obtained by taking all catches in those waters and subtracting the catches of locally based vessels (both obtained from MIMRA [2022a]).

**Table 10-3:** Catches of foreign-based offshore vessels

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Foreign purse seine catch (t) | 22,654 | 3,732 | 27,171 | 40,213 |
| Foreign longline catch (t) | 1,635 | 1,673 | 1,684 | 1,524 |
| Foreign pole/line catch (t) | 1,018 | 1,024 | 2,619 | 777 |

Source: MIMRA (2022a)

The value of the 2021 catch of 42,514 t by foreign-based vessels can be obtained by using price information in FFA (2022b) and adjusting for in-zone prices (FFA [2022b] gives delivered prices):

- Purse seine = US$49,582,629
- Longline = US$9,925,812
- Pole/line = US$1,458,429
- Total = US$60,966,870

### Freshwater catches

There are no freshwater fisheries in Marshall Islands.

### Aquaculture harvests

The readily available information on aquaculture in Marshall Islands indicates:

- The Convention on the International Trade of Endangered Species (CITES) database shows there were permits to enable the export of up to 17,174 giant clams from Marshall Islands in 2017, but the MIMRA 2021 Annual Report (MIMRA 2022b) states that only 7,000 were actually exported. The farm gate value is estimated to be US$4 per piece.
- MMRA staff indicate that in 2021 some non-exported giant clams were harvested for re-stocking purposes, perhaps 5,000 clams total.
- According to the MIMRA 2021 Annual Report (MIMRA 2022b), 10,000 pieces of live coral were exported in 2021 at a farm gate price of about US$4 per piece.
- According to the staff of Atoll Technology Marshall Islands, cage culture of moi (Pacific threadfin, a finfish) resulted in the export of about 8,000 pounds in 2018. In 2021 there were no exports but about 5,000 pounds (2,268 kg) of local sales for US$2.50 per pound.
- MIMRA staff indicate there have been no sales of pearls for a few years.

Using the above information, the 2021 aquaculture production of Marshall Islands can be crudely estimated to be 22,000 pieces and 2.3 t, with a farm gate value of US$85,500. This does not include the re-exports received from FSM and Kiribati.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values of the fishery and aquaculture harvests in 2021 can be made (Table 10-4).

**Table 10-4:** Annual fisheries and aquaculture harvest in Marshall Islands in 2021

| Harvest sector | Volume (t and pcs, where indicated) | Value (US$) |
|---|---|---|
| Coastal commercial | 1,200 | 3,400,000 |
| Coastal subsistence | 3,000 | 6,000,000 |
| Offshore locally based | 91,167 | 121,000,000 |
| Offshore foreign-based | 42,514 | 60,966,870 |
| Freshwater | 0 | 0 |
| Aquaculture | 2,3 t and 22,000 pcs | 85,500 |
| **Total** | **137,833 t and 22,000 pcs** | **191,452,370** |

The weak factual basis for the estimates of coastal commercial and coastal subsistence catches should be recognised.

Figures 10-1 and 10-2 show the volumes and values of Marshall Islands fisheries production in 2021. Aquaculture is not shown on the volumes figure due to the use of mixed units (pieces and tonnes).

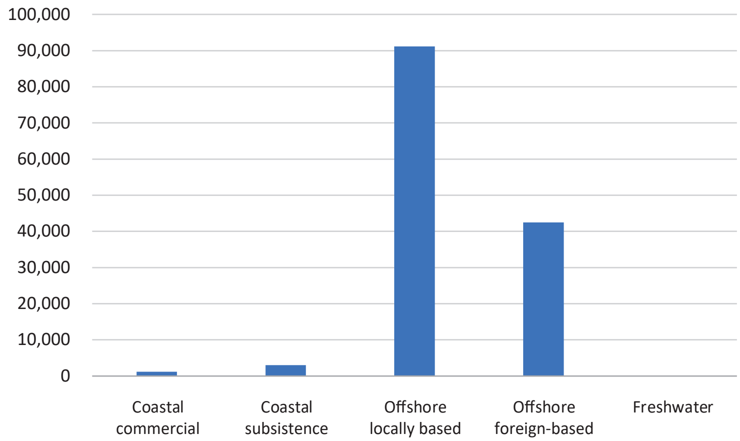



**Figure 10-1:** Marshall Islands fisheries production in 2021 by volume (t)

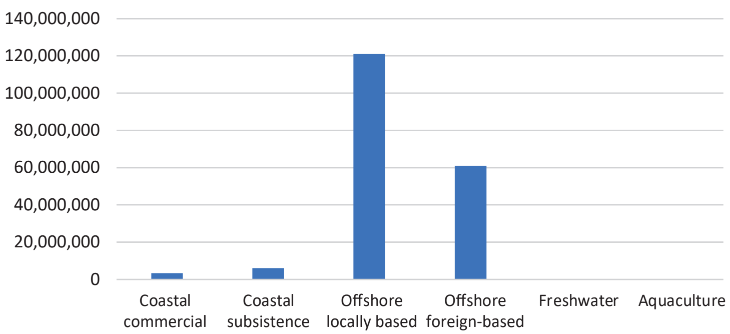



Figure 10-2: Marshall Islands fisheries production in 2021 by value (US$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for Marshall Islands from those four studies are given in Table 10-5.[1]

[1] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 10-5: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (US$) |
|---|---|---|---|
| Coastal commercial | 1999 | 444 | 973,000 |
| | 2007 | 950 | 2,900,000 |
| | 2014 | 1,500 | 4,350,000 |
| | 2021 | 1,200 | 3,400,000 |
| Coastal subsistence | 1999 | 2,800 | 3,836,000 |
| | 2007 | 2,800 | 4,312,000 |
| | 2014 | 3,000 | 6,000,000 |
| | 2021 | 3,000 | 6,000,000 |
| Offshore locally based | 1999 | 0 | 0 |
| | 2007 | 63,569 | 81,210,390 |
| | 2014 | 85,918 | 133,530,000 |
| | 2021 | 91,167 | 121,000,000 |
| Offshore foreign-based | 1999 | 33,217 | 50,000,000 |
| | 2007 | 12,727 | 19,572,712 |
| | 2014 | 29,754 | 38,700,638 |
| | 2021 | 42,514 | 60,966,870 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 25,000 pcs | 130,000 |
| | 2014 | 10,000 pcs | 50,000 |
| | 2021 | 22,000 pcs and 2.3 t | 85,500 |

Source: The present study, Gillett (2016), Gillett (2009), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for coastal commercial, coastal subsistence and freshwater change significantly between the years, but some of that change is due to the way in which the production was estimated. For example, the large increase in coastal commercial production between 2007 and 2014 is due to new information becoming available (i.e. the Echigo study). In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 10.2 Contribution of fishing to GDP

### Current official contribution

The Marshall Islands financial year (FY) 2021 Statistical Compendium (Graduate School 2021b), which contains the national accounts, was prepared by the Graduate School USA, Pacific Islands Training Initiative, Honolulu, Hawaii, in collaboration with the Economic Planning Policy and Statistics Office (EPPSO) of Marshall Islands. It was prepared under a contract with the United States Department of the Interior, Office of Insular Affairs. The fishing contribution to the nation's GDP is given in Table 10-6.

**Table 10-6:** Fishing contribution to GDP (US$ millions)

| | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 |
|---|---|---|---|---|---|
| Fishing contribution | 27.1 | 26.9 | 31.8 | 38.0 | 54.5 |
| Marshall Islands GDP at purchaser's price | 212.7 | 219.3 | 232.1 | 241.7 | 259.5 |
| Fishing as a % of GDP | 12.7% | 12.3% | 13.7% | 15.7% | 21.0% |

### Method used to calculate the official fishing contribution to GDP

The individuals at the Graduate School dealing with the national accounts of the Marshall Islands have a considerable amount of expertise and years of experience in Micronesia. After considering the situation carefully, those individuals have decided to treat the locally based fishing vessels as not being part of the Marshall Islands economy.

The present study can see advantages and disadvantages of including the locally based vessels in the Marshall Islands GDP. After thorough consideration, it was decided to not include the vessels and follow the lead of the Graduate School. An important factor in the decision is consistency across all study countries so as, for example, to treat the vessels of the Marshall Islands Fishing Venture in the same way that a similar company (Luenthai) is treated in Pohnpei.

In calculating the fisheries component of GDP, the Graduate School used a production approach. It examined, where possible, the financial accounts of fishing/processing companies to determine the value added, rather than relying on the more simplistic value-added ratios used by the present study.

### Alternative estimate of fishing contribution to GDP

Table 10-7 (below) represents an alternative to the official method of estimating fishing contribution to GDP in Marshall Islands. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 10.1 above (summarised in Table 10-4) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 10-7 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

**Table 10-7:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (US$, from Table 10-4) | VAR | Value added (US$) |
|---|---|---|---|
| Coastal commercial | 3,400,000 | 0.75 | 2,550,000 |
| Coastal subsistence | 6,000,000 | 0.85 | 5,100,000 |
| Offshore locally based | 0 | 0 | 0 |
| Freshwater | 0 | 0 | 0 |
| Aquaculture | 85,500 | 0.55 | 47,025 |
| **Total** | **9,485,500** | --- | **7,697,025** |

Source: Production sections, above

The US$7.7 million fishing contribution to GDP in 2021 equates to 3.0% of GDP. This is considerably less than the official contribution of 21.0% given above in the official GDP and considerably less than the 29.5% that was calculated in Gillett (2016). Some explanation is required:

- The large difference between the alternative fishing contribution to GDP and the official contribution is because the latter includes the shore-side operations of the fishing companies. While agreeing that those operations are part of the Marshall Islands economy, the present study feels that those operations are not part of the strictly defined fishing sector.

- The large difference between the alternative fishing contribution to GDP and that of Gillett (2016) is due to the latter including the fishing operations of the foreign-controlled companies. It was judged by the present study (and in the official approach) that the "centre of economic interest" (as defined by the System of National Accounts) of those operations (except for the Pan Pacific vessels) does not lie in the Marshall Islands.

Should individuals or agencies disagree with the approach taken by the present study, Table 10-7 (immediately above) can easily be adjusted.

## 10.3 Exports of fishery production

The Marshall Islands FY 2021 Statistical Compendium (Graduate School 2022) gives the fish exports of Marshall Islands (Table 10-8).

**Table 10-8:** Fish exports of the Marshall Islands (US$ millions)

| | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 |
|---|---|---|---|---|---|
| Exports of goods | 61.9 | 64.3 | 64.1 | 71.6 | 108.7 |
| Exports of fish | 38.3 | 38.0 | 42.3 | 55.5 | 85.0 |
| Fish as a % of all exports | 61.9% | 59.1% | 66.0% | 77.5% | 78.2% |

The following should be noted when considering the information in the table:

- There is a note in the compendium stating the export information above does not include the exports of "pelagic fishing vessels operated economically from abroad which are treated as non-resident".
- Pan Pacific Foods, a major exporter of fishery products, did not process any fish in 2021. In 2018 it exported 2,359 t of tuna loins, worth US$8.7 million (Graduate School 2021b).
- According to MIMRA staff, the exports listed in the table do not include that of "cooler trade", in which fish is shipped to Hawaii as personal baggage on passenger flights.

The Marshall Islands aquarium trade has grown considerably in recent years. Data kindly supplied by the Pacific Community (SPC)/Statistics for Development Division (SDD) was used to construct Table 10-9.

Table 10-9: Marshall Islands exports of aquarium products

| Live aquarium fish | | Invertebrates | | Giant clams | | Corals | |
|---|---|---|---|---|---|---|---|
| Year | Quantity | Year | Quantity | Year | Quantity | Year | Quantity |
| 2015 | 95,082 | 2015 | 12,905 | 2015 | 3,011 | 2015 | 5,874 |
| 2016 | 92,607 | 2016 | 15,200 | 2016 | 12,734 | 2016 | 26,888 |
| 2017 | 83,697 | 2017 | 67,243 | 2017 | 10,055 | 2017 | 16,984 |
| 2018 | 83,264 | 2018 | 76,552 | 2018 | 15,251 | 2018 | 22,606 |
| 2019 | 73,632 | 2019 | 25,200 | 2019 | 11,281 | 2019 | 26,983 |
| 2020 | 58,418 | 2020 | 24,400 | 2020 | 8,384 | 2020 | 21,108 |
| 2021 | 106,045 | 2021 | 18,501 | 2021 | 5,095 | 2021 | 24,489 |

Source: SPC/SDD Units: Pieces

Although values are not given in the above table, information in Gillett et al. (2020) indicates that the free-on-board (FOB) value of exports in FY 2018 is around US$750,000.

## 10.4 Government revenue from fisheries

In Marshall Islands there are two ways of dealing with revenue from fisheries:

- The money that MIMRA receives from its activities, which include vessel day scheme (VDS) revenue, fishing rights, licensing/registration, observer fees, transshipment fees, fishing violations, boat charter fees and other.
- The money that MIMRA contributes to the Marshall Islands government (i.e. the amount in the above point, less the cost of operating MIMRA).

Some of the categories of revenue (above) require some clarification. According to the MIMRA Executive Director and the MIMRA annual reports, the categories are defined as:

- "Fishing rights" = Access fees for pole-and-line and carriers/bunkers, and VDS administration fees, plus income from bilateral arrangements with Japan, the United States fisheries treaty, and the FSM Arrangement.
- "VDS revenue" = Access for the vessel day scheme for purse seiners.
- "Licensing/registration" = Administration fees: US$5,000 for a purse seiner, US$8,000 for a locally based foreign longliner, and US$8,000 per trip for a Japan-based longliner.

According to the MIMRA FY 2021 Annual Report (MIMRA 2022b), the money that MIMRA has contributed to the Marshall Islands government is:

- US$40.1 million in 2017
- US$29.4 million in 2018
- US$29.1 million in 2019
- US$31.3 million in 2020
- US$26.0 million in 2021

## Access fees for offshore fishing

The MIMRA categories of VDS revenue, fishing rights and licensing/registration are assumed to be roughly the access fees of the present study. Using data from the MIMRA FY 2021 Annual Report, Table 10-10 can be constructed.

**Table 10-10:** Access fees received by MIMRA (US$)

| | 2019 | 2020 | 2021 |
|---|---|---|---|
| VDS revenue | 26,027,040 | 28,112,074 | 28,143,896 |
| Fishing rights | 3,629,878 | 3,579,787 | 2,314,357 |
| Licensing/registration | 2,164,000 | 2,300,800 | 2,573,000 |
| **Total** | **31,820,918** | **33,992,661** | **33,031,253** |

These fees are shown in Figure 10-3.

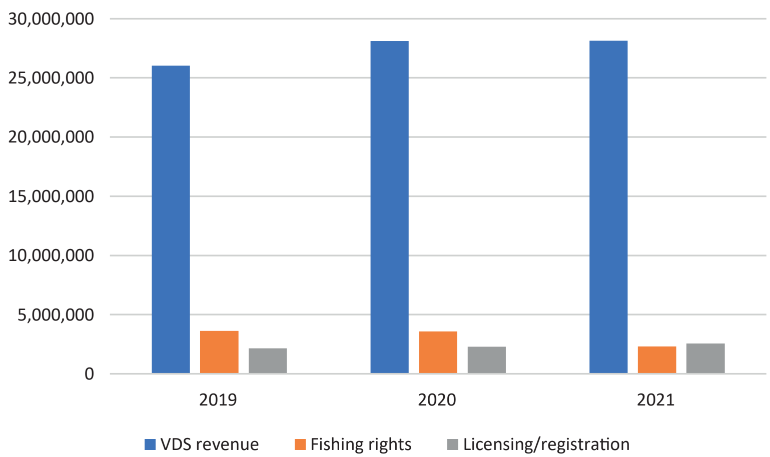



**Figure 10-3:** Access fees received by MIMRA (US$). Source: Table 10-10

The US$33.0 million in access fees received by MIMRA in 2021 equates to 18.9% of the total revenue of the Marshall Islands government of US$174.3 million.[2]

## Other government revenue from fisheries

Following from the above section, the non-access revenue received by MIMRA is considered to be observer fees, transshipment fees, fishing violations, boat charter fees and other. Using data from the MIMRA FY 2021 Annual Report, Table 10-11 can be constructed.

**Table 10-11:** Non-access revenue received by MIMRA (US$)

| | 2019 | 2020 | 2021 |
|---|---|---|---|
| Observer fees | 610,450 | 660,594 | 766,760 |
| Transshipment fees | 347,000 | 319,000 | 538,000 |
| Fishing violations | 600,000 | 100,000 | 200,000 |
| Boat charter fees | 0 | 0 | 0 |
| Other | 39,113 | 127,584 | 73,253 |
| **Total** | **1,598,582** | **1,209,198** | **1,580,034** |

According to MIMRA staff, small-scale fishing in Marshall Islands does not produce government revenue.

2 From the Marshall Island Statistical Compendium. Total revenue consists of tax revenue, social contributions, grants and other revenue.

## 10.5 Fisheries-related employment

There is no comprehensive source of fisheries-related employment in Marshall Islands. What exists is an assortment of information from the various fisheries sub-sectors in the country.

In an analysis of the purse seine tuna fishery value chain in Marshall Islands (Macfadyen et al. 2021), there is a good description of the employment situation in the country and its fisheries component (Box 10-1).

**Box 10-1:** Labour and the tuna value chain in the Marshall Islands

The Marshall Islands workforce is estimated at 11,066 in 2017, with public administration, wholesale and retail trade, extra-territorial organizations, transport/storage and communication, and fisheries being the industries with the highest numbers of workers. Notably, around one-third (32.6%) of the country's labor force is unemployed in 2017. Unemployment rates among youth and young adults are high and estimated to be as high as 50–60 percent in 2019. While one would suspect that this would lead towards a strong push towards employment within the fisheries sector, the tuna value chain actors cite the scarcity of labour as a challenge affecting their operations.

The scarcity of labour can partly be explained within the context of the Compact of Free Association, wherein Marshallese citizens are entitled to live, attend school, and work in the United States visa-free as "non-immigrant residents." Accordingly, both skilled and unskilled workers may—and often do—choose to migrate to the US for its higher wages and standards of living. Among tuna value chain workers, especially for labour at the Pan Pacific tuna loining plant, high wages at poultry processing plants can also appear attractive after gaining several years of experience. As such, lower skilled labour from in the Marshall Islands often move to work in the US.

Another factor in the tuna value chain's ability to access sufficient labour inputs in the RMI has been worker absenteeism. The Pan Pacific loining plant can employ up to 600 people but has only been able to secure around 350 on a regular basis. Oftentimes a worker in these lower-income positions will have extended family and community (e.g., church) obligations that have the effect of reducing their already minimum wage earners salary to even less. There is also a sentiment held by some in the local community that the purse seine industry is connected to the sex trade with primarily low paying jobs for uneducated segments of the population.

In the Marshall Islands 2019/20 HIES (EPPSO 2022), most of the fisheries-related employment data is aggregated with other sectors to form the category "Agriculture, forestry and fishery workers". The HIES does state that 15% of all households in the Marshall Islands participate in fisheries activities.

Formal employment in the fisheries sector is quite low. The Marshall Islands FY 2021 Statistical Compendium (Graduate School 2022) indicates that in 2021 there were 77 jobs in "fishing" and 428 jobs in "fisheries", which includes shore-based fish processing and vessel support services.

The FFA Economic Development Indicators report (Ruaia et al. 2020) provides tuna-related employment data for Marshall Islands, which includes harvest, processing and ancillary services sectors, observers and government employees (artisanal sector not included): 2016 (754 people employed), 2017 (754), 2018 (761) and 2019 (1,259).

By far, the largest amount of fisheries-related employment in Marshall Islands is that of the Pan Pacific tuna loining plant. Although the plant did not do any processing in 2021 (presumably due to Covid), employment was substantial in prior years. In 2016, 802 people were employed and in 2017, 533 people were employed (Graduate School 2021b).

Macfadyen et al. (2021) describe the gender component of the Marshall Island tuna value chain (VC):

> In the VC women account for around one-third of the RMI-resident fulltime and part-time workers in the core VC; and are mostly employed to work in the loining plant as unskilled (or low-skilled) workers to process the fish. Even though there are women involved in the administration/logistics/management tasks in the core VC and the support services of the VC (e.g., vessel agents), as well as in the VC's enabling environment (e.g., governmental fisheries offices (e.g., as observers), research institutions, and environmental NGOs), there are not many of those jobs and most are occupied by men. Furthermore, the jobs in the private sector that involve management roles and/or scientific work (e.g., lab work, quality control) are often recruited from overseas because very few RMI residents, especially women, possess these skills. Most of the job opportunities available to Marshallese women, therefore, are low paid manual jobs in the processing plant.

## 10.6 Levels of fishery resource consumption

The historical studies of fish consumption in Marshall Islands have been:

- A Japan International Cooperation Agency report (JICA 1983) states that the annual consumption of fish per capita on Majuro in the early 1980s was: local fish, 22.8 kg; canned fish, 8.6 kg; imported frozen fish, 0.3 kg; indicating a total of 31.7 kg.
- Johns Hopkins (1992) gave the frequency of eating eight categories of fishery foods in 75 households.
- The Office of Planning and Statistics' worksheet for calculating the fishing component of GDP contains information from an early 1990s household expenditure survey. From that survey, the subsistence fishery contribution to fish consumption in Marshall Islands can be estimated to be about 59.0 kg per year.
- Burton et al. (1997) gave the average number of meals per week containing local fish and imported fish at Mili, Namu and Laura.
- Using 1995 Food and Agriculture Organization (FAO) production, import and export information, Preston (2000) estimated a per capita supply of fish in the Marshall Islands of 38.9 kg per year.
- Gillett and Lightfoot (2001) reviewed the fisheries nutrition literature of Marshall Islands up to mid-2001 and made two overall observations: (a) there is considerable difference in consumption between the population centres of Majuro and Kwajalein, where 68% of the population resided in 1999, and the outer islands, where fish is relatively plentiful; and (b) leakage of fish from the transshipment operations and longline bases in Majuro is probably having a substantial effect on the supply of fish on that island.
- McCoy and Hart (2002) show that per capita consumption of "local marine animals" by the 1,915 people on Ailinlaplap Atoll in 2001 was 1.75 lbs per week. This equates to 42.3 kg annual per capita consumption.
- OFCF and MIMRA (2004) state: "Food supply - That first point is food supply to Majuro people. Total fish catch amount estimated [at] about 2 million lbs in whole Majuro atoll [per] year. [Considering] the Majuro population of 23,000 people, this equates to 88 lbs average fish supply amount to 1 person." (88 lbs equates to 39.9 kg)
- At Laura on Majuro Atoll, per capita consumption of fresh fish was found to be almost 90 kg/person/year (Pinca et al. 2009b).
- Echigo (2010) examined the fish consumption on four outer islands in 2009. The results indicated the annual per capita fish consumption: Jaluit (45.3 kg), Likiep (138.2 kg), Namdrik (158.6 kg) and Ailuk (159.0 kg).

- McCoy (2012) examined the "leakage" of fish from the major tuna transshipment ports in the Pacific Island region. Very little leakage was found to exist in Majuro. Some fish are obtained by government officers during regular boarding and according to agents, some shore-side dock workers insist on being provided with one or two fish in addition to being paid for their labour. The lack of leakage may be attributable to the lack of market for the relatively low-quality fish, the preference of Marshallese for reef fish, and the availability of alternative fish supplies at local stores and fish markets.
- Gillett (2016) stated that if the Marshall Islands coastal fisheries production in 2014 of 4,500 t is divided by the 2014 population of 54,550, the result would be 82.5 kg of fish per person per year. This per capita fish consumption figure does not consider reef fish exports, non-residents in Marshall Islands that consume local fish, or domestic consumption of the leakage from tuna transshipment operations.

More recently, the Marshall Islands 2019/20 HIES (EPPSO 2022) contains information on fish consumption:

- Fish contributes 8% of dietary energy consumed.
- An average of 180 g/capita/day of fish and fish products is consumed. This equates to an annual per capita consumption of 65.7 kg.
- Consumption of mackerel and other canned fish products is substantial.
- Only 43% of households consume reef fish, while 64% of households consume fish canned in oil, although in small amounts (6 g/capita/day)
- Whereas fresh tuna is consumed by around 24% of urban households, it is not consumed at all in rural areas where mainly reef fish is consumed.
- Tuna fish is five times more expensive than reef fish.

As Majuro was the world's largest tuna transshipment port for many years, there is a substantial amount of fish that is rejected during transshipment. In an analysis of the tuna fisheries of Marshall Islands (McCoy 2019), the subject of rejected fish is discussed (Box 10-2).

**Box 10-2:** The trade in fish rejected from transshipment operations

The utilization of purse seine bycatch onshore is a controversial topic in many Pacific Island countries. Allowing the flow of bycatch (including tuna rejects, species undesirable for processing, smashed and damaged fish, etc) can contribute to food security. It can also cause significant disruption in local markets for fresh fish. In Majuro, it is known that there is at least some "leakage" ashore via vessel crew, observers, government boarding parties, and the like. One local processor of fish jerky gets his raw material supply from Taiwanese purse seiners, and even some of the MIMRA fish market's raw material is said to originate from transshipping purse seiners anchored in the lagoon.

At least one local purse seine operator claims that it is illegal for bycatch to be brought ashore from transshipping vessels. Perusal of RMI fishery laws, inquiries to MIMRA, the RMI Ports Authority (both were said to be the source of the regulation) and shipping agents failed to turn up any concrete evidence of a regulatory prohibition of the practice.

In some countries, the sale ashore of bycatch from transshipping vessels is an important contribution to local food security. In Solomon Islands for example, it is estimated that upwards of 300 tons is brought ashore into the Honiara market, and that from a highly seasonal transshipping port with far less volume handled than Majuro.

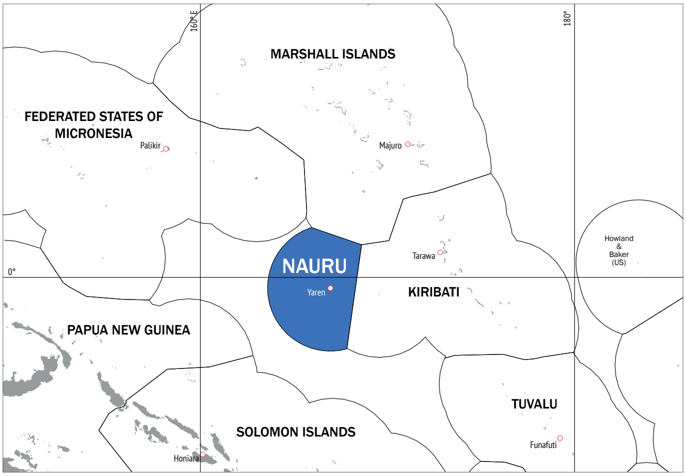
A recent FFA survey assessed the contribution of landings from locally-based commercial tuna fishing vessels to food security. Administrative measures are said to have been recently put in place by MIMRA that have reduced the amount of such fish brought ashore by government employees. Monitors work onboard the purse seine vessels during operations and are able to set aside some bycatch and bigeye tuna from the catch when authorised by the captain or others in charge. The fish is typically placed in salt sacks and taken ashore. Considering that a complete transshipment takes from 3 to 5 or more days depending on the load and weather conditions, the total amounts could be relatively large.

Overall, one would think that the availability of fish, i.e. bycatch and discards, would be a boon to local consumers. But there are concerns from fishermen and some retailers that bringing this supply ashore would stifle sales of locally-caught fish, even though there is a clear preference for reef fish by those with the ability to pay the ever-increasing prices in Majuro.

## 10.7 Exchange rates

Marshall Islands uses the US dollar (US$).

# 11 Nauru




## 11.1 Volumes and values of fish harvests in Nauru

### Coastal commercial catches in Nauru

The following describes the major historical attempts to consolidate information on coastal fisheries production in Nauru:

- Dalzell et al. (1996), citing Dalzell et al. (1992), gave the following catch information: subsistence fisheries – 98 tonnes (t), worth US$219,600; commercial fisheries – 279 t, worth US$628,605. The price was assumed to be US$2.25 per kg for both the subsistence and commercial landings.
- Gillett and Lightfoot (2001) considered the above survey and other sources to produce an estimate of coastal commercial fisheries production of 315 t (worth A$514,250) and an estimate of coastal subsistence production of 110 t (worth A$1,732,500).
- The Pacific Community (SPC) conducted fieldwork around Nauru in October and November 2005. The aim of the survey work was to provide baseline information on the status of reef fisheries in the country (Vunisea et al. 2005). The survey estimated that the annual catch of finfish was 589.4 t, with most caught for subsistence (55–72%), some distributed on a non-monetary basis (17–20%) and some sold (8–27%). For invertebrates, the annual catch was estimated at 27 t, with all but some lobster catch used for home consumption.
- Gillett (2009) considered the above surveys, a 2006 household and expenditure survey (HIES), the views of an expatriate fisheries adviser

residing in Nauru, a report by an SPC fisheries specialist, a report by a Forum Fisheries Agency (FFA) fisheries specialist, recent population changes, and the recent severe economic crisis in Nauru. The report stated: "For the purpose of the present study the 2007 coastal commercial fisheries production on Nauru is estimated to be 200 mt, worth A$1,000,000."

- Gillett (2016) took into consideration the several changes that were pointed out by a resident fisheries advisor, a survey carried out in 2010 on perceptions about changes in Nauru coastal fisheries, and a 2012/13 HIES. The study reported that the coastal commercial catch was 163 t, worth A$1,306,955 to fishers.
- A regional study conducted by Tolvan et al. (2019) looking at the Nauru artisanal catch of tuna and other pelagic species estimated the amount of tuna to be 310 t in 2016, whilst the Nauru government had reported a higher catch of 524 t in 2014.

Currently, Nauru's artisanal fleet is comprised of canoes and motorised skiffs fishing either for subsistence, barter or sale (NFMRA 2022). It is expected that the number of active motorised boats has increased in the last few years through the Nauru fisheries outboard motor and boat trailer project, which involves providing trailers and outboard motors at a subsidised price. The government has a programme to deploy fish aggregation devices (FADs) to support the fishery by concentrating fish in an area accessible to fishers. According to the staff of Nauru Fisheries and Marine Resources Authority (NFMRA), there is only one FAD currently in place.

Nauru's Annual Report to the Western and Central Pacific Fisheries Commission (WCPFC) Scientific Committee (NFMRA 2022) provides information about artisanal fisheries data collection in Nauru (Box 11-1).

**Box 11-1:** Artisanal fisheries data collection

There are two fisheries data collectors that meet a randomly selected number of fishers coming back from their fishing trips at the three main landing sites (Gabab Channel, Anibare Community Boat Harbour and the Aiwo Boat Harbour). The data collectors only record (pelagic) species and weight of catch, this information is then entered immediately on tablets using TAILS, an app developed by SPC. For a good estimate of annual production, the catch landing data will need to be raised using fishing activity data which is basically the number of boats and canoes that goes out fishing on a daily basis. The current data collection program has not been collecting this information regularly and therefore estimate of annual production may not be accurate. Discussions between NFMRA and SPC to improve the data collection of fishing activity data have been undertaken, now the fishing activity data have been collected. The results from this program are used by NFMRA to produce the artisanal fisheries data in the annual WCPFC report.

Source: NFMRA (2022)

The preliminary results from Nauru's report to the Scientific Committee (NFMRA 2022) indicate an annual artisanal pelagic catch of about 3.1 t in 2021. This seems to suggest an overall declining trend for the past six years (the artisanal fleet catch in 2016 was 12.99 t), but these values are from the TAILS system and may only be the sampled catch, which would be misleading. Because of the importance of Nauru's artisanal pelagic catch, this may significantly underestimate coastal commercial catch.

To obtain prices paid to fishers for coastal finfish and invertebrates, discussions were held during the present study with the coastal fisheries staff at NFMRA in November 2022. The results are given in Table 11-1.

**Table 11-1:** 2021 fish prices in Nauru

| | Commodity | Selling unit | Estimated price per kg (A$) |
|---|---|---|---|
| Finfish | Reef fish | Per string | 12.5 |
| | Tuna (to local people) | Per kg | 9 |
| | Tuna (to Chinese restaurants) | Per kg | 15 |
| | All fish | Per kg | 11 |
| Invertebrates | Periwinkle | Per 10 kg sack | 17.5 |
| | Crab | Individual | 3 |
| | Lobster | Individual | 50 |

Source: Estimates from NFMRA staff

It was noted that invertebrates are not commonly caught, purely based on the fact that they are not abundant. Harris et al. (2015) conducted a survey of reef invertebrates, and the results provide evidence of significant overexploitation of Nauru's costal invertebrates.

For making new estimates of coastal fisheries production in Nauru, it is important to note that:

- Apart from the artisanal catches in NFMRA's report to the Scientific Committee, there is not much data/records for making estimates.
- Fuel prices have gone up recently, which have increased the price of fish (fish prices fluctuate with fuel prices), and this would have restricted fishing activities of some families that cannot afford high-price fuel.
- Nauru had its first Covid case in 2022, which led to a two-month national lockdown in the months June and July of that year. With the exception of essential workers, all movements were restricted, and people

had to work from home. Discussion with staff of NFMRA and one of the data collectors shows that the one of the major impacts of Covid was through restrictions on boat movements.

- NFMRA (2022) states that pelagic and non-pelagic catches from boats seemed to have decreased in recent years. For example, during the visit to Nauru in November 2022 for the present study, when accompanying one of the data collectors to Gebab Channel, no fisher claimed to have caught any fish that morning. According to the data collector, that was not uncommon.

Selectively using the above information (and giving credibility to the Gillett [2016] estimate), it appears that in the last 10 years the catch volume has decreased slightly while the catch value has increased.

Although the available information is inadequate for making a good estimate of the production of the coastal commercial fisheries of Nauru, a crude approximation of the 2021 production would be about 140 t, worth A$1,540,000 to fishers.

### Coastal subsistence catches

There is no recent readily available information on the production of coastal subsistence fisheries in Nauru. However, there are older estimates that were made in the previous Benefish studies:

- Gillett (2001) estimated an annual production of 110 t in 2000, worth about A$514,250 to fishers.
- Gillett (2009a) estimated a production of 450 t, worth A$787,000 to fishers.
- Gillett (2016) estimated the coastal subsistence production in 2014 to be 210 t, worth A$1,177,834 to fishers.

Currently, no fishers or vendors could be seen at the only fish market, which is located in Anibare, as people do not sell their fish there as in the past. Fishers now usually use their catch for home consumption and when fish is sold, most is sold from home. According to a senior fisheries officer (M. Depaune, per. com. November 2022), coastal catch is comprised of 60% commercial production, while subsistence production makes up 40%.

For the purposes of the present study, it is estimated that the volume of production from coastal subsistence fisheries in Nauru in 2021 is about 100 t, worth A$770,000.

## Locally based offshore catches

During 2021, the vessels Naoero Star and Naoero Sun were registered in Nauru. The fleet expanded to 19 purse seiners and 2 support vessels in 2021 (NFMRA 2022). The vessel details are given in Table 11-2.

**Table 11-2:** National fleet structure in 2021

| | Purse seiner | Tanker | 0–500 GRT | 501–1000 GRT | 1001–1500 GRT | 1500+ GRT | Total |
|---|---|---|---|---|---|---|---|
| 2018 | 2 | 0 | 0 | 0 | 0 | 2 | 2 |
| 2019 | 7 | 2 | 0 | 0 | 0 | 7 (PS) 2 (TK) | 9 |
| 2020 | 14 | 2 | 0 | 0 | 8 (PS) | 4 (PS) 2 (TK) | 16 |
| 2021 | 19 | 2 | 0 | 0 | 8 (PS) | 11 (PS) 2 (TK) | 21 |

Source: NFMRA (2022), GRT = gross registered tonnage, PS = purse seiner, TK = tanker

Nauru's Annual Report to the WCPFC Scientific Committee (NFMRA 2022) gives the catch and effort of the locally based vessels (Table 11-3).

**Table 11-3:** Catch and effort of Nauru's national fleet in the Convention Area

| | Vessels | Trips | Days | | Species (t) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | At sea | Fishing | Skipjack | Yellowfin | Bigeye | Other | Total |
| 2018 | 2 | 9 | 275 | 165 | 7,079 | 1,711 | 40 | 1 | 8,831 |
| 2019 | 9 | 45 | 1,120 | 743 | 29,555 | 3,450 | 349 | 89 | 33,443 |
| 2020 | 14 | 125 | 3,834 | 2,427 | 81,473 | 11,940 | 2,264 | 193 | 95,870 |
| 2021 | 19 | 160 | 4,533 | 2,699 | 84,787 | 24,577 | 2,330 | 127 | 111,821 |

Source: NFMRA (2022)

The catches above are given as "Nauru's National Fleet" presumably because of the Nauru registration of the vessel. For the purposes of the present study, the category "locally based offshore" is for vessels that are part of the Nauru economy, offload catch in Nauru, and make important decisions on the operations of the vessels from Nauru, with the important test being whether Nauru is the centre of economic operations of the vessels. If the vessel passes this test, then under international guidelines they contribute to Nauru's GDP. This subject will be discussed further in the section below on fishing contribution to GDP.

Following the WCPFC report, the 2021 locally based offshore catch was 111,821 t. Using pricing information in FFA (2022b) and discounting to give in-zone prices (the FFA prices are destination prices), this tuna was worth US$135,303,410 (A$186,718,705).

## Foreign-based offshore catches

The Nauru report to the WCPFC Scientific Committee (NFMRA 2022) states that in 2021 Nauru licensed 223 purse seiners (0 longliners) to operate in its exclusive economic zone (EEZ). In support of those fishing fleets, 17 tankers and 2 fish carriers were also licensed.

The foreign-based vessels fishing in the Nauru EEZ in 2021 were primarily from South Korea, Taiwan, China and Japan. The catches by the foreign fleets are given in Table 11-4.

**Table 11-4:** Foreign fleet catches in Nauru's EEZ (t)

| Year | Skipjack | Bigeye | Yellowfin | Total |
|---|---|---|---|---|
| 2017 | 48,543 | 1,467 | 19,040 | 69,162 |
| 2018 | 142,428 | 1,569 | 17,159 | 161,495 |
| 2019 | 57,185 | 774 | 7,457 | 65,688 |
| 2020 | 81,612 | 3,494 | 14,408 | 99,644 |
| 2021 | 108,179 | 3,256 | 25,458 | 136,893 |

Source: NFMRA (2022)

In 2021 foreign-based offshore fishing in the Nauru zone produced 136,893 t of tuna. Using pricing information in FFA (2022b) and discounting to give in-zone prices (the FFA prices are destination prices), this tuna was worth US$165,640,530 (A$228,583,931)

## Freshwater catches

There are four depressions on the Nauru plateau, the most significant one forming Buada Lagoon, with a surface area of 30,000 m$^2$. The other water bodies, known as ponds, are on the fringing coast or within a few metres of the base of the escarpment. They range from about 40 m$^2$ to about 10,000 m$^2$ in area and are either man-made or naturally occurring. Anabare pond is the largest, at 10,000 m$^2$. The only freshwater catches made in Nauru are tilapia, but this is not a popular food fish.

## Aquaculture harvests

Currently, about 100 kg of milkfish is produced annually, which is worth about A$10 per kg or a total of A$1,000.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values of the fishery and aquaculture harvests of Nauru in 2021 can be made (Table 11-5).

Table 11-5: Annual fisheries and aquaculture harvest in Nauru in 2021

| Harvest sector | Volume (t) | Value (A$) |
|---|---|---|
| Coastal commercial | 140 | 1,540,000 |
| Coastal subsistence | 100 | 770,000 |
| Offshore locally based | 111,821 | 186,718,705 |
| Offshore foreign-based | 136,893 | 228,583,931 |
| Freshwater | 0 | 0 |
| Aquaculture | 0.1 | 1,000 |
| **Total** | **248,954.1** | **417,613,636** |

Figures 11-1 and 11-2 show the volumes and values of Nauru fisheries production in 2021.

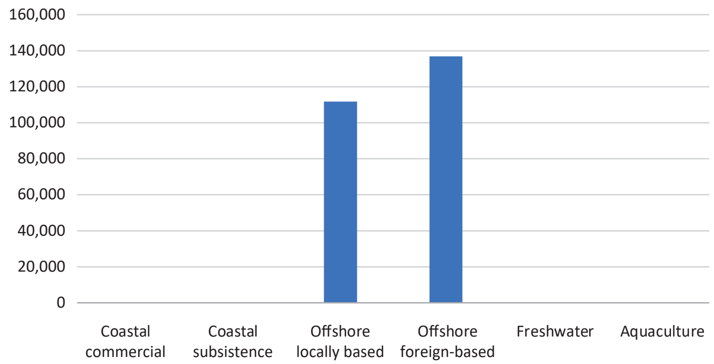



Figure 11-1: Nauru fisheries production in 2021 by volume (t)

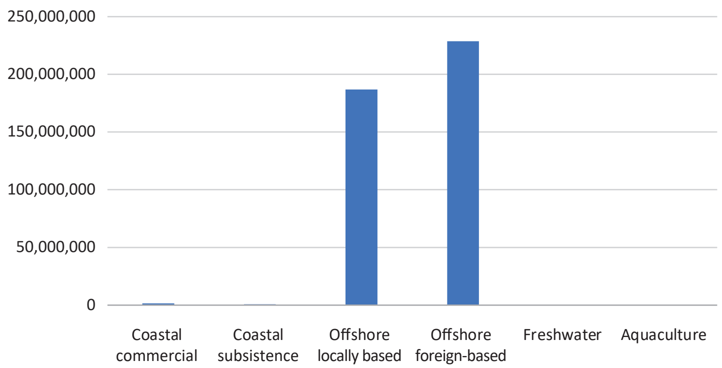



Figure 11-2: Nauru fisheries production in 2021 by value (A$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for Nauru from those studies are provided in Table 11-6.

**Table 11-6:** Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t) | Nominal value (A$) |
|---|---|---|---|
| Coastal commercial | 1999 | 315 | 1,732,500 |
| | 2007 | 200 | 1,000,000 |
| | 2014 | 163 | 1,306,955 |
| | 2021 | 140 | 1,540,000 |
| Coastal subsistence | 1999 | 110 | 514,250 |
| | 2007 | 450 | 787,000 |
| | 2014 | 210 | 1,177,834 |
| | 2021 | 100 | 770,000 |
| Offshore locally based | 1999 | 50 | 387,000 |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 111,821 | 186,718,705 |
| Offshore foreign-based | 1999 | 41,000 | 57,000,000 |
| | 2007 | 69,236 | 95,201,620 |
| | 2014 | 177,315 | 282,100,000 |
| | 2021 | 136,893 | 228,583,931 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 8 | 18,000 |
| | 2014 | 0.1 | 1,000 |
| | 2021 | 0 | 0 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies represents a real change in production in some cases, but this can also represent a change in the methodology used for measuring production (hopefully, an improvement), or the availability of new information. In the table above the production levels for coastal commercial and coastal subsistence change significantly between the years, but some of that change is due to the way in which the production was estimated. In contrast, changes in production figures in the table for the offshore fisheries (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 11.2 Contribution of fishing to GDP

### Current official contribution

The official GDP of Nauru and the fishing contribution to GDP are given in Table 11-7.

**Table 11-7:** Fishing contribution to GDP

| | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 |
|---|---|---|---|---|---|
| Fishing contribution to GDP (millions of A$) | 2.6 | 2.6 | 2.8 | 3.7 | 3.7 |
| GDP at current prices (millions of A$) | 133.8 | 144.5 | 169.1 | 169.1 | 186 |
| Fisheries as a % of GDP | 1.9% | 1.8% | 1.7% | 2.2% | 2.0% |

Source: Nauru Bureau of Statistics (unpublished data)

### Method used to calculate the fisheries contribution to GDP

The GDP estimates for Nauru are made by the Pacific Financial Technical Assistance Centre (PFTAC) (R. Detenamo, per. com. November 2022). The method used to calculate the fisheries contribution to GDP is currently being revised by PFTAC, with a mixture of both income and production (mostly) approaches used.

### Alternative estimate of fishing contribution to GDP

Table 11-8 (below) represents an alternative to the above method of estimating fishing contribution to GDP in Nauru. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 11-1 above (summarised in Table 11-5) and determines the value added by using value-added ratios

(VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 11-8 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

**Table 11-8:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (A$, from Table 11-5) | VAR | Value added (A$) |
|---|---|---|---|
| Coastal commercial | 1,540,000 | 0.65 | 1,001,000 |
| Coastal subsistence | 770,000 | 0.80 | 616,000 |
| Offshore locally based | 0 | 0 | 0 |
| Freshwater | 0 | 0 | 0 |
| Aquaculture | 1,000 | 0.85 | 850 |
| **Total (A$)** | **2,311,000** | --- | **1,617,850** |

In the above estimate, the catches of "Nauru's National Fleet" are not included. To be included, those vessels would need to be part of the Nauru economy, with the centre of economic activity in Nauru. Should individuals or agencies in Nauru feel that the vessels are part of the Nauru economy, their contribution could be added to the above table.

## 11.3 Exports of fishery production

Currently, there are no formal exports of fishery products from Nauru.

## 11.4 Government revenue from fisheries

### Access fees for offshore fishing

Nauru's Department of Finance budget lists the following fishing access fees received (Table 11-9):

**Table 11-9:** Nauru's access fees (A$)

| Financial years | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 |
|---|---|---|---|---|---|
| 1055 - Support vessel charges | 185,546 | 278,483 | 326,526 | 426,855 | 566,692 |
| 1071 - Purse seine revenue - licensing | 536,980 | 1,437,904 | 1,745,909 | 1,393,798 | 1,098,032 |
| 1072 - Purse seine revenue - fishing days | 45,640,517 | 70,278,915 | 71,206,717 | 57,977,121 | 56,524,277 |
| Total access revenue | 46,363,043 | 71,995,303 | 73,279,152 | 59,797,774 | 58,189,001 |
| Total government revenue | 180,905,330 | 240,017,786 | 269,996,331 | 265,880,056 | 319,174,555 |
| Percent fisheries revenue of total government revenue | 26% | 30% | 27% | 22% | 18% |

Source: Nauru Department of Finance (unpublished data)

Government revenue from fisheries in 2021 was A$58,189,001, making it 18% of total government revenue.

### Other government revenue from fisheries

Information is not readily available on the Nauru government's revenue from fisheries that is not associated with fishing vessel access.

## 11.5 Fisheries-related employment

There is very little new information on fisheries-related employment in Nauru. Some of the historical studies are:

- A report by the Pacific Regional Coastal Fisheries Development Programme (Vunisea et al. 2005) states that due to the economic crisis at the beginning of the decade, there was a dramatic increase in fishing and gleaning. From a fisheries-focused socioeconomic survey, 245 households were surveyed for income and expenditure, with 97% of these found to be engaged in fishing activities. A total of 405 finfish fishers (357 men and 48 women) and 283 invertebrate fishers (149 women and 134 men) were interviewed. Survey results indicate an average of 3.7 fishers per household. In extrapolating this, the total number of fishers in Nauru is 4,513: 2,947 men and 1,566 women. The main source of income is from government employment (86%), with some people employed in the private sector. Fisheries do not play a significant role in income for households. For 5% of respondents, it is their first income and for 17%, it is their second income.

- The Nauru 2011 census (Anon. 2012) estimates the main source of household income for 85% of all households was wages and/or salary. Seven percent of the households' main income came from their own business activities, 4% relied mainly on rent of land, and 2% on the sale of fish, crops or handicrafts. Just over half (51%) of all households in Nauru were engaged in fishing activities.
- The 2012/13 HIES (NBS 2014) estimates that 26% of households were engaged in fishing. Just under 9% of the Nauruan labour force of 3,952 was involved in some form of fishing, equating to about 353 fishers. With regard to full-time fishers, if "full-time" means those who have fishing as their main activity, only 1.26% of the Nauruan labour force appeared to have fishing as the main activity, equating to about 50 fishers. With regard to part-time commercial fishers, if this is taken as those who have fishing as a secondary activity, 7.7% of the Nauruan labour force was in this category, representing about 300 fishers. With regard to subsistence fishers, in Nauru, all fishers, whether full-time or part-time, also fish for their subsistence, so this represents all fishers (i.e. 353 fishers). There is a significant difference in results between the 2011 census and the 2012/13 HIES. The census indicates that just over half (51%) of all households in Nauru were engaged in fishing activities, while the HIES estimated that 26% of the households were engaged in fishing.
- Gillett (2016) showed that NFMRA is a significant employer. It had 25 staff involved with coastal fisheries, five in oceanic fisheries, 13 in corporate services and a Chief Executive Officer, for a total of 44 staff (B. Yeeting, per. com. January 2016).

More recently, NFMRA (2022) advised that their staff consists of 64 employees altogether, 20 of which are women. They estimate that 40% of all fishers in Nauru depend solely on fishing as a source of employment in Nauru. Men typically go out fishing in the morning, while women are mainly in charge of selling. It is estimated that only 10% of fishers are women, and that they mainly participate in gleaning (S. Benjamin, per. com. November 2022). FFA (2022a) reports that in the period 2018–2020, there was an average of 85 people employed in the tuna industry.

Unpublished data from the 2019 HIES shows the total active population (by nationality) aged 15+ years working in the formal marine fishing sector. It gives a total of 3,719 men and women working in the sector (out of a total population of 11,550 in Nauru). Results from the survey are given in Table 11-10.

**Table 11-10:** Employment in the formal marine fishing sector in Nauru

| | Nauruan | I-Kiribati | Tuvaluan | Chinese | Fijian | Australian | Other nationality |
|---|---|---|---|---|---|---|---|
| Male | 2,024 | 57 | 12 | 16 | 31 | 12 | 39 |
| Female | 1,445 | 38 | 4 | 8 | 15 | 4 | 14 |
| Total | 3,469 | 95 | 16 | 24 | 46 | 16 | 53 |

Source: NBS (unpublished data)

## 11.6 Levels of fishery resource consumption

There is little readily available information on the levels of fishery consumption in Nauru. Some of the results of earlier studies on fisheries consumption in Nauru are:

- Dalzell and Debao (1994) estimated a 1991 per capita catch rate of 45 kg per person per year.
- Gillett and Lightfoot (2001) estimated an annual per capita consumption of fishery products on Nauru of 46.7 kg in the late 1990s.
- An SPC/CoFish study (Vunisea et al. 2005) examined the consumption of fishery products. Per capita consumption of fresh fish was recorded at being 46.5 kg/year.
- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate the annual per capita fish consumption (whole weight equivalent) to be 55.8 kg, of which 96% was fresh fish.
- Gillett (2016) estimates a 2014 coastal fisheries catch rate of 35 kg per person per year (i.e. 373,000 kg; 10,660 people).

For the present study, the Nauru Bureau of Statistics compiled information on the consumption of fishery products in Nauru from the 2019 HIES (unpublished). There are 1,713 households in Nauru, and 324 households were surveyed. Results are given in Table 11-11.

**Table 11-11:** Consumption of fishery products on Nauru in 2019 according to the Nauru Bureau of Statistics

| Type of fish consumed | Number of households reported eating the fish |
|---|---|
| LOCAL: Reef fish (trevally, parrot, emperor, snapper, surgeon etc.; fresh or frozen) | 121 |
| LOCAL: Pelagic fish and bottom fish (tuna, wahoo, mahi mahi, shark, snapper etc.; locally produced caught) | 87 |
| LOCAL: Other seafood (e.g. dried or smoked fish; locally produced) | 21 |
| LOCAL: Invertebrates (crabs, octopus, clams etc.; locally produced) | 19 |
| IMPORTED: Canned/tinned fish (tuna, mackerel, sardine etc.; imported) | 54 |
| IMPORTED: Frozen seafood (frozen fish, frozen seafood; produced overseas) | 22 |

Source: NBS (unpublished data)

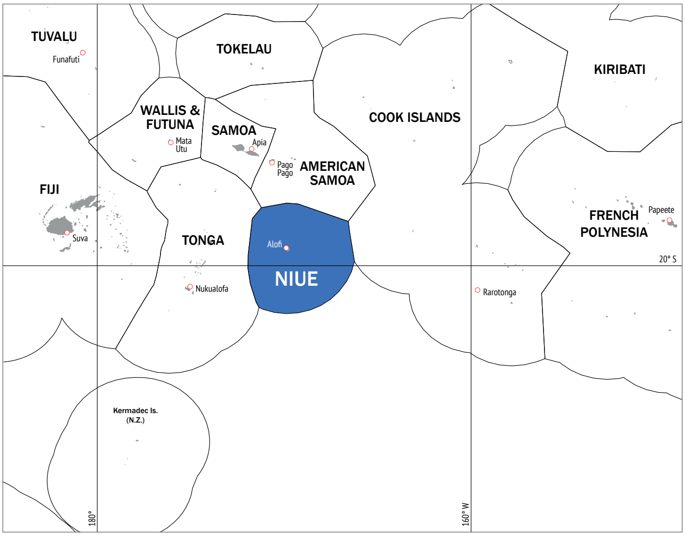
The present study estimates the production from coastal fisheries (commercial and subsistence) and aquaculture in Nauru in 2021 to be 240.1 t. With a population of 11,832 in Nauru in 2021, that equates to annual per capita fish consumption of 20.3 kg; however, this does not include imports of fish.

## 11.7 Exchange rates

Nauru uses the Australia dollar (A$). The average yearly exchange rates (A$ to the US dollar) used in this book are as follows:

| 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|
| 1.37 | 1.37 | 1.29 | 1.42 | 1.44 | 1.32 | 1.38 | 1.53 |

# 12 Niue




## 12.1 Volumes and values of fish harvests in Niue

### Coastal commercial catches in Niue

The following describe historical attempts to estimate the production from coastal fisheries:

- Dalzell et al. (1993) used information from a Pacific Community (SPC) nutrition survey carried out in Niue in 1978 to estimate a total catch of about 115 tonnes (t) per year, with an additional 4.9 t per year exported to New Zealand during periods of direct air connections.
- Dalzell et al. (1996), using reference material from 1990, estimated that the annual production from subsistence fisheries was 103 t, worth US$471,504 (or about NZ$7.64 per kg), and the production from commercial fisheries was 12 t, worth US$54,720.
- Gillett and Lightfoot (2001) considered the results of a household survey in 2000, in addition to the figure historically used by the Niue Department of Agriculture, Forestry and Fisheries, and other information to estimate a coastal commercial catch of 12 t (worth NZ$96,000) and a coastal subsistence catch of 194 t (worth NZ$315,640).
- The SPC Pacific Regional Oceanic and Coastal Fisheries (PROCFish) project surveyed Niue in June 2005. As part of that work, estimates were made of the annual production in various categories of fishing (reef

finfish catch, harvests from mid-water and trolling fishing, and invertebrate harvests), which came to a total annual harvest of 164.9 t.

- Gillett (2009a) considered information on factors that could affect coastal fishery production, the results of recent surveys and prices of fish. Coastal fisheries production in 2007 was estimated to be 150 t, comprising commercial production of 10 t (worth NZ$80,000 to fishers) and subsistence production of 140 t (worth NZ$840,000).
- Gillett (2016) assumed the PROCFish work was the most reasonably accurate way that coastal fisheries production was estimated. Considering changes that could have affected coastal production, the 2005 PROCFish coastal production estimate was adjusted to produce an estimate of 165 t for the year 2014, made up of 11 t of commercial catch (worth NZ$148,500 to fishers) and 154 t of subsistence catch (worth NZ$1,455,300 to fishers).

There are limited sources of information on the changes in coastal fisheries production in Niue in the period 2014–2021. Niue currently does not have a fisheries statistics system. SPC support was provided in 2015/16 for data collection; however, due to a mishap with the data collector, work was discontinued. The SPC Tuna Fisheries Data Management (TUFMAN) system has been used, but data collection is not maintained. The available information includes the Agriculture Census Report, a 2020/21 Department of Agriculture, Forestry and Fisheries (DAFF) Report, information on changes in population, and information from a local consultant engaged for the present study on changes in the production of coastal fisheries.

The Agriculture Census Report (Anon. 2021b) has information enabling a comparison of fisheries activities between the 2021 census and the 2015/16 household income and expenditure survey (HIES) report:

- From the 2015/2016 HIES, Niue was estimated to have 513 households with a resident population of 1,611 persons, while in 2021 Niue was reported to have 528 households with a population of 1,720, representing a 6% increase.
- In the period 2015–2021, the percentage of people engaged in fishing activities increased from 38% to 50%.
- The proportion of households that sell their fish was 5% in 2015 and 3% in 2021.

According to the 2021/22 DAFF Annual Report (Anon. 2022), there are 12 fish aggregating devices (FADs) currently in place (four offshore and eight inshore). It is reported that there are a total of 58 active boats and 12 charter boats in Niue. For 2021 it is estimated that the combined pelagic catch for boats and canoe fishers is 3.4 t. Reef fish species are traditionally caught for home consumption by a limited number of fishers, and this is confirmed by the presence of mainly pelagic fish for sale in local shops and restaurants (Bosserelle et al. 2018).

In recent years there have been some changes that could have affected coastal fisheries production. According to a local consultant engaged for the present study (J. Tamate, per. com. January 2023):

- In 2017 Niue committed 40% of its exclusive economic zone (EEZ) to be a no-take protected area for commercial purposes. This was formalised in April 2020 with the establishment of the Moana Mahu.
- Local demand for fish is always high. Since there is no formal fish outlet or market, fish is sold via social media.
- Average prices paid to fishers were NZ$13.50/kg in 2014 and NZD$15/kg in 2021.
- Covid did not affect coastal production because Niue receives goods from overseas, so subsistence fishing did not seem to increase significantly as expected.

The above information suggests that there are influences that would tend to both increase and decrease coastal fisheries production, with perhaps a slight increasing effect. Using the above information selectively, it is estimated that the coastal fisheries production in Niue in 2021 was 169 t, made up of 9 t of commercial catch (worth NZ$135,000 to fishers) and 160 t of subsistence catch (worth NZ$2,400,000 to fishers).

### Coastal subsistence catches

Following the above approach, the coastal subsistence fish catch in Niue in 2021 is estimated to be 160 t. Using the farm gate system of valuing subsistence production (discounting prices for commercial fish by 30%), this would be worth NZ$1,680,000 to fishers.

### Locally based offshore catches

Gillett (2016) indicates that at the beginning of 2005, Niue began licensing longline vessels to fish under charter arrangement. The vessels, ranging in size from 10 to 29 meters, fished into the new government joint venture fish processing facility, Niue Fish Processors Ltd. In 2006 there were 13 longliners based in Niue. The Director of DAFF indicates that production from the boats reached a maximum in 2006 and early 2007. Fishing operations stopped in December 2007.

There has been no locally based offshore fishing in Niue since 2007.

### Foreign-based offshore catches

In the year 2021, no foreign-based vessels were licensed to fish in Nauru (DAFF 2020). U.S. purse vessels are authorised under a multilateral treaty to fish in Niue waters, but actual fishing in Niue waters by those vessels has not occurred in many years.

### Freshwater catches

There are no freshwater fisheries in Niue.

### Aquaculture harvests

There is no aquaculture activity in Niue.

### Summary of harvests

From the above sections, a crude approximation of the annual volumes and values of the fishery and aquaculture harvests in 2021 can be made. (Table 12-1).

Table 12-1: Annual fisheries and aquaculture harvest in Niue in 2021

| Harvest sector | Volume (t) | Value (NZ$) |
|---|---|---|
| Coastal commercial | 9 | 135,000 |
| Coastal subsistence | 160 | 1,680,000 |
| Offshore locally based | 0 | 0 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 0 | 0 |
| Aquaculture | 0 | 0 |
| **Total** | **169** | **1,815,000** |

Figures 12-1 and 12-2 show the volumes and values of Niue fisheries production in 2021.

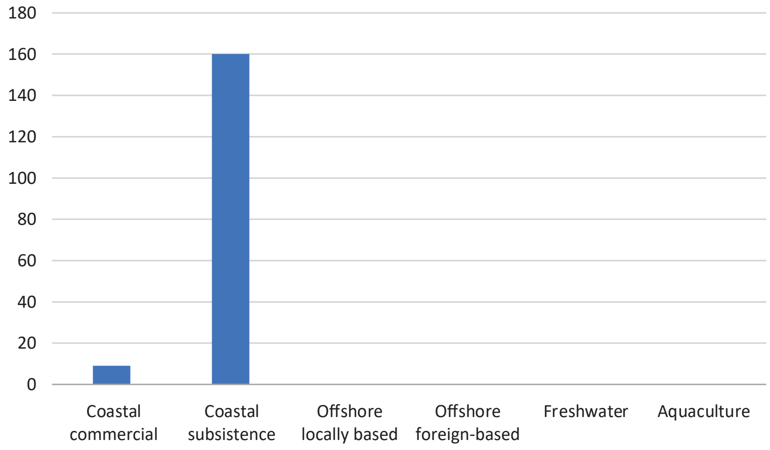



**Figure 12-1:** Niue fisheries production in 2021 by volume (t)

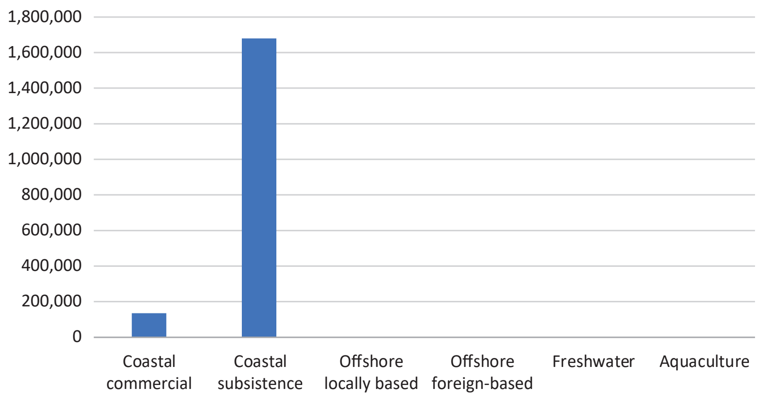



**Figure 12-2:** Niue fisheries production in 2021 by value (NZ$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study focuses on 2021. The fishery production levels for Niue from those four studies are presented in Table 12-2.

Table 12-2: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t) | Nominal value (NZ$) |
|---|---|---|---|
| Coastal commercial | 1999 | 12 | 96,000 |
| | 2007 | 10 | 80,000 |
| | 2014 | 11 | 148,500 |
| | 2021 | 9 | 135,000 |
| Coastal subsistence | 1999 | 194 | 315,640 |
| | 2007 | 140 | 840,000 |
| | 2014 | 154 | 1,455,300 |
| | 2021 | 160 | 1,680,000 |
| Offshore locally based | 1999 | 0 | 0 |
| | 2007 | 640 | 2,508,000 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Offshore foreign-based | 1999 | 2 | 8,000 |
| | 2007 | 0 | 0 |
| | 2014 | 547 | 1,944,943 |
| | 2021 | 0 | 0 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies represents a real change in production in some cases, but this can also represent a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for coastal commercial and coastal sometimes change significantly between the years, but some of that change is due to the way in which the production was estimated. For example, the 2002 HIES in Niue gave a different (and apparently better) estimate of coastal subsistence production. In contrast, changes in production figures in the table for the offshore fisheries (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 12.2 Contribution of fishing to GDP

### Current official contribution

The latest year for which a Niue GDP estimation is available is 2018. Unfortunately, in the available information, fisheries cannot be disaggregated from agriculture, hunting and forestry. Table 12-3 shows the available information.

**Table 12-3:** The agriculture and fisheries contribution to the Niue GDP (current prices, NZ$ thousands)

| | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|
| Niue GDP (current prices) | 33,749 | 35,066 | 36,536 | 43,536 |
| Agriculture, hunting, fishing and forestry contribution | 5,200 | 5,262 | 5,448 | 5,538 |
| Agriculture, hunting, fishing and forestry as a % of GDP | 15.4% | 15% | 14.9% | 12.7% |

Source: National Statistics Office website (https://niuestatistics.nu/stats/)

### Method used to calculate the official fishing contribution to GDP

Technical assistance is provided to the National Statistics Office by the Pacific Financial Technical Assistance Centre. The methodology used for calculating the components of the fisheries contribution to GDP is not readily available.

### Alternative estimate of fishing contribution to GDP

Table 12-4 (below) represents an alternative to the official method of estimating fishing contribution to GDP in Niue. It is a simplistic production approach that takes the values of two types of fishing/aquaculture activities for which production values were determined in Section 12.1 above (summarised in Table 12-1) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 12-4 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

Table 12-4: Fishing contribution to GDP 2021 using an alternative approach

| Harvest sector | Gross value of production (NZ$, from Table 12-1) | VAR | Value added (NZ$) |
|---|---|---|---|
| Coastal commercial | 135,000 | 0.65 | 87,750 |
| Coastal subsistence | 1,680,000 | 0.85 | 1,428,000 |
| Offshore locally based | 0 | 0 | 0 |
| Freshwater | 0 | 0 | 0 |
| Aquaculture | 0 | 0 | 0 |
| **Total (NZ$)** | **1,815,000** | --- | **1,515,750** |

As the official GDP contribution from agriculture, hunting, fishing and forestry has not been disaggregated into its components in a public document, it is not possible to compare the fishing contribution of the alternative estimate to the official fishing contribution.

## 12.3 Exports of fishery production

Gillett (2016) states that since Niue Fish Processors and the associated longlining ceased activities in late 2007, there have been no formal exports of fishery products from Niue. Informal fish exports occurred as passenger baggage on flights to Auckland, but these are not monitored.

According to Statistics Niue (2022), in 2021 fish exports were NZ$5,050, representing 0.46% of all exports in that year.

## 12.4 Government revenue from fisheries

### Access fees for offshore fishing

There has been no locally based offshore fishing in Niue since 2007.

In 2021 no revenue was generated from bilateral foreign fishing arrangements. However, under the terms of the U.S. Multilateral Tuna Treaty, Niue and other Pacific Island countries receive payments from the U.S. government and the U.S. tuna industry. Although U.S. purse seiners have not attempted to fish in Niue in over 20 years, Niue still receives these payments, averaging NZ$1–1.3 million on an annual basis depending on the exchange rate (J. Tamate, per. com. January 2023).

According to the DAFF Annual Report (DAFF 2022), in 2021 Niue received NZD$1,298,136 in fisheries revenue. Table 12-5 gives the fisheries revenue for the past several years.

Table 12-5: Fisheries access revenue

| Year | Fisheries revenue (NZ$) | Total government revenue (NZ$) | Fisheries revenue as a % of total government revenue |
|---|---|---|---|
| 2017/18 | 1,191,956 | 29,518,085 | 4.0% |
| 2018/19 | 1,524,624 | 28,056,598 | 5.4% |
| 2019/20 | 1,487,130 | 27,294,277 | 5.4% |
| 2020/21 | 868,065 | 25,125,223 | 3.5% |
| 2021/22 | 1,298,136 | 29,920,073 | 4.3% |

Source: J. Tamate, per. com. January 2023

### Other government revenue from fisheries

No information is readily available on the amount of any such revenue in Niue.

## 12.5 Fisheries-related employment

There is very little new information on fisheries-related employment in Niue. Some of the historical studies are:

- The SPC PROCFish survey in 2005 estimates 597 fishers (346 males and 251 females) in Niue. Of these, 170 fish only for finfish (155 males and 15 females), 75 only harvest invertebrates (13 males and 62 females), and 352 fish for both finfish and invertebrates (178 males and 174 females), although not necessarily during one single fishing trip. Niue's population does not depend on the primary sector for income generation, but rather on salaries and private business: salaries are the major source of revenue for 60% of households, while for 30% of all households, private business is the main revenue source. Only 10% of all households surveyed reported that fisheries provide a complementary income (and another 18% gained a secondary income from selling agricultural produce).
- The 2009 Agriculture census of Niue (Statistics Niue 2010) indicates that most households are engaged in inshore fishing (62%), 31% are involved in both inshore and offshore fishing, with the remaining 7% involved in offshore fishing only. This shows that fishing in Niue is still more of a subsistence activity than commercial fishing. Household participation in fishing activity is very high across the country, with Toi having the highest participation rate (89%), where eight out of nine households were involved in fishing in the last 10 months. The main purpose of household fishing activity is for home consumption, accounting for 82% of fishing households, with 16% selling some of their catches, and the remaining 2% of fishing households fishing mainly for the purpose of sale. Of the 564 people who were engaged in fishing in the week before the census night, 201 were females and 363 were males.

- Gillett (2016) indicates that there are about 10 people who spend at least 50% of their time in fishing and could be considered the core of commercial fishing in Niue, according to a Niue-based fisheries economist (J. Tamate, per. com. December 2015). Those 10 people represent about 1.4% of Niue's 737-person work force.

The 2015/16 Niue HIES contains information about participation in fisheries (Table 12-6).

- The HIES report (Statistics Niue 2018) indicates that out of the 528 households covered in the survey, 50% (264 households) were engaged in fishing activities. In these fisheries households, consisting of 1,016 members, about 62% were males and 38% were females.
- An analysis of households by type of fishing activity reveals that 48.86% of the households were engaged in inshore fishing only, 18.18% in offshore fishing only, and 32.95% used both methods of fishing.
- Data were collected on the number of fishing trips made to sea during the months of May–July. An analysis of the data shows that the 264 households made 3,087 trips during these 3 months, indicating that on an average, a household made just 3.90 trips per month, i.e. 3–4 trips a month.

**Table 12-6:** The number of fishing trips made, quantity of fish captured, purposes of fishing and proportion sold by month

| Fishing | May | June | July | Total |
|---|---|---|---|---|
| Number of households catching fish | 264 | 264 | 264 | 792 |
| Number of fishing trips made | 1,137 | 982 | 968 | 3,087 |
| Average number of fishing trips | 4.31 | 3.72 | 3.67 | 3.9 |
| Quantity of fish captured (kg) | 5,051.5 | 4,404.5 | 4,725.7 | 14,181.7 |
| Average quantity of fish captured (kg) | 19.13 | 16.68 | 17.9 | 17.91 |
| Proportion of households fishing only for home consumption | 72.14% | 74.81% | 72.54% | 73.12% |
| Proportions of households fishing mainly for home consumption and some sale | 19.29% | 12.21% | 17.61% | 16.46% |
| Proportion of households fishing mainly for sale and some home consumption | 6.43% | 6.87% | 7.75% | 7.02% |
| Proportion of households fishing only for sale | 0% | 0% | 0% | 0% |
| Proportion of households fishing for other purposes | 2.14% | 6.11% | 2.11% | 3.39% |
| Number of households selling fish | 39 | 33 | 39 | 111 |

Source: Statistics Niue (2018)

## 12.6 Levels of fishery resource consumption

There is little readily available recent information on the level of fishery consumption in Niue. Some of the results of earlier studies on fisheries consumption in Niue are:

- Dalzell et al. (1993) used per capita fish consumption data from a 1987 SPC nutrition study to estimate annual per capita consumption of 40.8 kg food weight or about 49.0 kg whole fish weight.
- Gillett and Lightfoot (2001) considered: (1) the Niue population of 1,900 people in 2000, (2) subsistence fisheries production of 194 t, (3) commercial fisheries production of 12 t and (4) fishery imports of 20 t. From this information, they determined that the annual per capita consumption of fishery products in Niue in 2000 was about 118.9 kg.
- SPC's PROCFish project conducted fieldwork around Niue in May and June 2005. Based on interviews with about half of the households, the following estimates of fish consumption were made: (1) quantity fresh fish consumed (kg/capita/year), 31.03 kg (±2.28); (2) quantity fresh invertebrate consumed (kg/capita/year), 2.53 kg (±0.33); and (3) quantity canned fish consumed (kg/capita/year), 17.17 kg (±1.26). This survey produced an annual per capita fish consumption of 112.0 kg in Niue for the year 2005.
- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate an annual per capita fish consumption (whole weight equivalent) of 79.3 kg, some of which was imported.
- Gillett (2016) made an estimation of 110 kg per capita per year, without considering informal fish exports and canned fish imports.

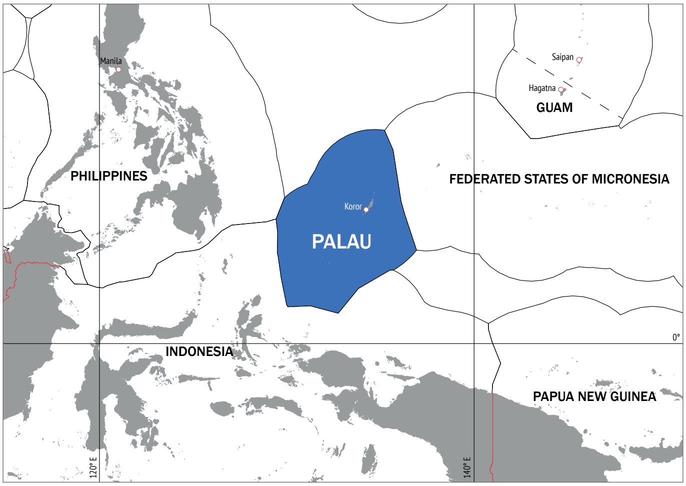
In the present survey, production from coastal commercial and subsistence fisheries is estimated to be 169 t in 2021. Considering the population of Niue was 1,720 (Anon. 2021b) in 2021 this equates to 98 kg per capita per year, without considering informal fish exports or canned fish imports.

## 12.7 Exchange rates

Niue uses the New Zealand dollar (NZ$). The average yearly exchange rates (NZ dollar to the US dollar) used in this book are as follows:

| 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| 1.44 | 1.42 | 1.48 | 1.50 | 1.40 | 1.47 | 1.74 |

# 13 Palau




## 13.1 Volumes and values of fish harvests in Palau

### Coastal commercial catches in Palau

The major attempts to consolidate information on coastal fisheries production in Palau in recent years include the following:

Preston (1990) gives the total inshore catch (including subsistence) as 1,700 tonnes (t).

- Kitalong and Dalzell (1994) examined several estimates of subsistence production in Palau, concluding: "Given the uncertainty surrounding these production estimates, it is probably most realistic to suggest that the subsistence fishery production for Palau may lie somewhere between 500 and 1,100 mt per year."
- Dalzell et al. (1996) used the 1992 annual report of the Division of Marine Resources to estimate coastal commercial fisheries production of 736 t (worth US$2.4 million) and subsistence production of 750 t (worth US$1.8 million).
- The Palau Conservation Society (PCS 2000) examined all available information on the amount of inshore catch in Palau for the years 1989–1998. An estimate of fishery production was made from that information and from individuals familiar with the fishery sector. PCS concluded that the annual average catch in the period 1989–1998 was 2,115 t.

- Gillett and Lightfoot (2001) decided that the above PCS (2000) estimate was the most accurate available and divided that estimate into coastal commercial and subsistence components of 865 t (worth US$2,595,000) and 1,250 t (worth US$2,500,000), respectively.
- Gillett (2009a) considered the above studies, as well as some more recent information: (1) the results of the 2006 household income and expenditure survey (HIES), (2) some fisheries-focused surveys, (3) changes in production indicated by the surveys of some of the markets, (4) the views of fisheries specialists with long involvement in Palau fisheries, and (5) factors that may have influenced fishery production levels in recent years. Gillett (2009a) concluded that there is a general consensus on the validity of the PCS survey, and the recent information on coastal fisheries production in Palau is equivocal. He therefore estimated that the volume of coastal commercial production in the mid-2000s remained at 865 t (with a value of US$2,843,000 to fishers), and the volume of subsistence coastal production was 1,250 t (with a value of US$2,511,000 to fishers).
- Lingard et al. (2011) is a "reconstruction" of Palau's marine fishery catch for the period 1950–2008. The estimate was made by interpolating between years of known data for human population data and per capita fish consumption rates. The total reconstructed catch for Palau, which includes subsistence, artisanal, locally based tuna fisheries and baitfish, totalled 200,817 t for the period 1950–2008. On average, subsistence catches represented approximately 60% of the total coastal catches (subsistence and artisanal combined).
- Rhodes et al. (2011) state that the "locally marketed reef fish catch" in Palau was 214 mt (±60 mt) per year based on communication with staff of the Bureau of Marine Resources (BMR). The report also states: "Both marketed supplies and exports have held steady, each at 214 mt ± 60 mt/year (2001–2009)."
- Gillett (2016) considered events that could have affected coastal fisheries (e.g. the growth in tourism, incidence of typhoons, reduction of fish from the Southwest Islands and periodic bans on certain fish species). He also took into consideration the general feeling among fisheries specialists in Palau that 30–50% of Palau's commercial fish catch for consumption goes through the store known as Happy Fish Market – and was able to get throughput volume/value data from that market. The study concluded that it was most appropriate to maintain the coastal production volumes estimated in the Gillett (2009a) study and to increase the values given in that study to 2014 values. Palau's coastal commercial fisheries production in 2014 was estimated to be 865 t, worth US$3.2 million to fishers.

A study by the Pacific Community (SPC) in 2014 carried out creel surveys focused on fishers landing at the Happy Fish Market (HFM) in Koror. Assuming the data collected for August 2014 are representative of any given month, these figures equate to approximately 142.11 t of fish passing through the HFM on an annual basis (Moore et al. 2015). Gillett (2016) indicates the general feeling among fisheries specialists in Palau that 30–50% of Palau's commercial fish catch for consumption goes through the Happy Fish Market. This "Happy market indicator" together with the feeling of fisheries specialists results in an estimate of annual coastal commercial production of 284 to 471 t – very small compared to some of the estimates cited in the points above.

Recently, there have been significant advancements in the estimation of the production of Palau's coastal fisheries. From August 2016 to June 2018, literature reviews and key informant interviews were carried out on "nearshore and offshore fisheries" to (1) estimate the current market size and structure; (2) document the volumes, forms and prices of fish throughout the market chain; and (3) estimate fish consumption by different end consumers (Dacks et al. 2020). This study shows the complexity of the distribution channels for coastal fishers in Palau (Box 13-1). Information from the study contributes to learning the value and volume of the production (Table 13-1).

**Box 13-1: Distribution channels for the production of coastal commercial fisheries in Palau**

Fishing on reefs and other nearshore areas is done by small-scale, local fishers. An estimated 1,700 fishing households in Palau (~35% of households) catch an estimated 2,115 mt of reef fish annually, although a recent fisher survey in four states, when extrapolated to all 16, suggests this could be a gross underestimate; the true catch volume could be up to twice as much. The fish market in Koror likely gets 30–50% of the catch (259.6–432.5 mt), although this estimate is uncertain. As explained by the fish market owner, there are about 80 small-scale fishers that sell their catch to the market in Koror. About half of the fishers that sell to the market are line fishers (i.e., bottom fishing and/or trolling) that mostly fish during the full moon. The other half of the fishers are spear fishers that mostly fish during new moon. Three of the fishers who sell to the market use gill nets and mostly catch rabbitfish (Siganidae). The fish market's customer base includes restaurants (22.2 mt), overseas supermarkets (<5 mt, as this is total volume of reef and pelagic fish exported), and individual customers (unknown; during election seasons (which occur frequently in Palau), political campaigns purchase large volumes of fish for fundraisers (up to 20% of their supply). Local fishers also sell their catch to fishing cooperative that on-sells to the Ministry of Education for serving in school lunches (1.3 mt). It is presumed that some catch is sold directly by local fishers to residents, but this volume is unknown.

Source: Modified from Dacks et al. (2020)

Table 13-1: Estimates of the primary components of the coastal commercial fisheries production and distribution in Palau

| | Description | Estimated annual volumes |
|---|---|---|
| Reef fish | Local fisher to residents (i.e. direct sales) | Unknown |
| | Local fisher to export | 31–33 t |
| | Local fisher to fish market | 150 t |
| | Local fishers to fishing cooperative | 1.3 t |
| | Local fishers to prepared food stores | 10.7 t |
| | Local fishers to entrepreneurs | Unknown, but at least 19.4 t |
| | Local fishers to supermarkets | 9.8 t |
| | Local fishers to restaurants | 13.6 t |
| | Local fishers to caterers | 71.1 t |
| Pelagic fish | Catch of local small-scale offshore fishers | 45 t |

Source: Modified from Dacks et al. (2020)

The big unknown for estimating coastal commercial fisheries production from the Dacks et al. study (2020) is the potentially large component "Local fisher to residents". It also should be noted that much of the information collected is somewhat dated (from 2016–2018).

Some other features are important for estimating the current coastal commercial fisheries production of Palau. There was an excellent survey in Palau during the period 1989–1998 (mentioned above) that estimated the annual production of inshore fisheries to be 2,115 t (PCS 2000). Since that period, the following surveys have used the PCS tonnage as a basis for their studies: Gillett and Lightfoot (2001), Gillett (2009a), Gillett (2016) and Dacks (2020). It is important to note, however, that there have been many changes in Palau in the past 23 years.

- Between 1998 and 2021, the population of Palau declined 2.5% (SPC/SDD).
- Between 2005[1] and 2021, the GDP per capita increased 37.8% (SPC/SDD).
- The number of tourists visiting Palau increased from 56,501 in 2000 to 168,421 in 2015 and 89,379 in 2019. Due to Covid, the number of tourists fell to 3,400 in 2021.

[1] The earliest year for which GDP per capita data is readily available.

- The Dracks et al. study (2020) found that in the study period, tourists only consumed between 1.9% and 4.0% of the reported total reef fish caught in the country (4.7–9.8% of the commercial catch).
- Several studies have indicated a decline in important inshore food fish in recent years (e.g. Moore et al. [2015], Lindfield [2017]).
- In the past, part of the catch of foreign-owned locally based longliners contributed to the fish supply for local residents and overseas visitors. Since those longliners departed Palau in preparation for the establishment of the Palau National Marine Sanctuary, commercial coastal fishing has filled the gap to some extent.
- Palau reactivated its nearshore fish aggregation device (FAD) programme in the late 2010s. Assistance from outside agencies such as the Food and Agriculture Organization (FAO) and SPC resulted in additional FADs being deployed, enabling small-scale fishers easier access to pelagic fish.
- In April 2020 a ban was introduced on the export of any living resource that primarily inhabits the reef areas, territorial sea and internal waters of Palau.

Some of the points above would tend to increase coastal commercial fisheries production, while others would have the opposite effect. The net effect is largely unknown, as is the amount in the category "Local fisher to residents" in the table above.

With respect to prices of fish in Palau, Dacks et al. (2020) indicate:

> A curious observation is that prices at the lower end of the value chain (i.e., paid to fishers) are not sensitive to market conditions. Prices paid to fishers and at the markets have remained stable (both for tuna/other pelagics as well as reef fish) for 20 years, despite fluctuations in demand and supply…The fish market does not appear to be generating large profits from the nearshore fishery, as their prices have remained almost constant over the last 20 years and the markup between the buying and selling prices is quite small (~$1.50/kg for reef fish).

During the present study, market prices for fish ranged between US$2.25 to $4.00 per pound (average of $6.89 per kg). The estimated average price to fishers is about $1.38 cheaper than the market price, or $5.51 per kg to the fishers (price information from Bureau of Fisheries staff).

Considering the various facts and anecdotes in this subchapter, it is not possible to estimate the production from Palau's coastal commercial fisheries. For the purposes of the present study, an educated guess of the production of coastal fisheries in 2021 is 1,000 t, worth $5,510,000.

## Coastal subsistence catches

It is generally accepted by fishery stakeholders in Palau that the production of coastal subsistence fisheries is greater than that of the coastal commercial fisheries according to the terms as defined in this report (Section 3.4). There is some new information available on the subsistence–commercial balance:

- One of the surprises of the Dacks et al. study (2020) is the large proportion of reef fish that is used non-commercially, not just for everyday consumption, but for customary events and non-commercial export (i.e. cooler trade). The cooler export trade is discussed in Box 13-4 of the export section of this chapter.
- Dacks et al. (2020) also found that the amount of coastal fish exported is 10.1 t commercial and 104.8 t non-commercial.
- Information from the 2014 Palau HIES (OPS 2015) shows that combining home produced and consumed with home produced and gifted (both defined as subsistence in the present study), half of the fish and seafood consumed in Palau is caught or produced by the household, while the remainder is cash purchased. Due to the import of fishery products, this finding does not mean that the consumption of coastal commercial fisheries and coastal subsistence are equal. During the five-year period 2017–2021, Palau imported an annual average of US$1,246,441 worth of "fish and crustaceans, molluscs and other aquatic invertebrates" (Ministry of Finance, unpublished data).

As with the coastal commercial fisheries production in Palau, the coastal subsistence fish catch is difficult to quantify. An educated guess is that the coastal subsistence production is about 1,400 t. Using the farm gate system of valuing subsistence production (discounting prices for commercial fish by 30%), this would be worth US$5,399,800 million to fishers.

## Locally based offshore catches

A prerequisite for understanding locally based offshore fishery in Palau is a knowledge of the Palau National Marine Sanctuary (Box 13-2).

**Box 13-2:** The Palau National Marine Sanctuary

In 2015, Palau enacted the Palau National Marine Sanctuary (PNMS) Act to protect 500,238 km$^2$ of its ocean under full closure, representing 80% of its exclusive economic zone (EEZ), by 2020 (Republic of Palau Public Law). The goal of the Act is to preserve and manage the stocks, health, and beauty of Palau's waters and natural resources by limiting fishing in its oceanic waters. While fishing will be banned in ~80% of the EEZ, fishing will still be allowed in ~20% of the EEZ within 24 miles from Palau's EEZ baseline. The original Act called for all catches to be landed in Palau and effectively prohibited exports of pelagic fish, with the exception of those catches by free school purse seine vessels. Recent amendments to the Act passed in June 2019 expanded the export ban exemption to include long line vessels and increased the export tax of tuna and species of bill fish from $0.35/kg to $0.50/kg. Alongside these protections, the Act calls for support of a domestic offshore fishery within the open 20% of the EEZ to supply domestic markets.

The Palau National Marine Sanctuary Act denoted a "wind-down" period from passage in January 2015 through implementation in December 2019 in which vessel days utilised in Palau's waters were reduced in a stepwise approach each December 31st passage and full implementation. However, when full implementation of the PNMS occurred, the waters of the Sanctuary shifted to a "no take" zone immediately.

80% of the EEZ is designated as a no-take area, with the remaining 20% being established as a Domestic Fishing Zone (beginning at the boundary of the territorial sea and extending outward into Palau's EEZ for an area of approximately 85,896 square kilometres) where only locally based vessels may operate and from which exports are banned, with the exception of tuna caught in free-schooling purse seine operations.

The Palau International Coral Reef Center has received seven grants/sources of funding, totalling nearly $3.9 million dollars, to manage the PNMS.

Sources: Dacks et al. (2020), PICRIC website, Skirtun and Hare (2017), Lewis et al. (2022)

The objective of this section of the report is to estimate the volumes and values of offshore production from the industrial-size vessels that are based in Palau and are part of the Palauan economy.[2] This information will be used several times in later sections of this report, including for the estimation of the fishing contribution to GDP. Identifying which Palauan vessels fall into this study category is complicated by the vessel nomenclature used by the various studies:

[2] The subject of residency of offshore vessels is covered in Appendix 2 of this book: "National accounting and the fishing sector".

national vessels, national-flagged vessels, national fleet, chartered vessels, locally based offshore fleet and domestic fleet.

Although a substantial number of longline vessels have been based in Palau in the past, the winding down period for the Palau National Marine Sanctuary has had a large impact on the number of locally based vessels. Lewis et al. (2022) provide "Longline fleet statistics (2011–2021)", but it is not possible to determine how many of those vessels were based in Palau and part of the Palauan economy for GDP purposes.

In this situation, it is the strategy of the present study to assume that the 2021 locally based longliner operations are not part of the Palau economy. If for some reason agencies in Palau have reason to disagree with this concept, the volumes and values of those catches (and associated contribution to GDP) can easily be adjusted in later sections of this report.

The report to the Western and Central Pacific Fisheries Commission (WCPFC) (Oiterong and Sisior 2022) states that in 2021 Palau licensed one domestic-based foreign-flagged longline vessel. Its recorded catch totalled 40.76 t: 17.7 t bigeye, 16.18 t yellowfin, 5.34 t blue marlin and 1.79 t swordfish. For the value of that catch, the approach taken in the present study is to use the Forum Fisheries Agency (FFA) spreadsheet (FFA 2022b). That document provides estimates of the volumes and values of catches of the four main commercial species of tuna in the WCPFC area using catch data sourced from the Oceanic Fisheries Programme of the Pacific Community. The FFA data show that the catch of the 2021 Palau-based longliner was worth US$395,250.

## Foreign-based offshore catches

In recent years, Palau has licensed foreign longliners and purse seiners of various nationalities to fish its exclusive economic zone (EEZ). The number by gear and year are given in Table 13-2, the longline catches in Table 13-3 and the purse seine catches in Table 13-4.

**Table 13-2:** Number of foreign-based offshore fishing vessels in the Palau EEZ

| | Number longliners | Number purse seiners | Number total vessels |
|---|---|---|---|
| 2021 | 27 | 39 | 66 |
| 2020 | 34 | 49 | 83 |
| 2019 | 34 | 61 | 95 |
| 2018 | 35 | 47 | 82 |
| 2017 | 23 | 32 | 55 |

Source: Oiterong and Sisior (2022)

**Table 13-3:** Catches by foreign-based longliners in the Palau EEZ (t)

| | Albacore | Bigeye tuna | Yellowfin tuna | Other | Total catches |
|---|---|---|---|---|---|
| 2021 | 3.36 | 897.06 | 314.53 | 99.97 | 1,314.92 |
| 2020 | 0.61 | 454.68 | 105.53 | 51.07 | 611.89 |
| 2019 | 3.44 | 54.34 | 30.47 | 4.94 | 93.19 |
| 2018 | 0 | 19.05 | 5.88 | 1.06 | 25.99 |
| 2017 | 2.47 | 1,211.14 | 504.9 | 105.62 | 1,824.13 |

Source: Oiterong and Sisior (2022)

**Table 13-4:** Catches by foreign-based purse seiners in the Palau EEZ (t)

| | Bigeye tuna | Skipjack | Yellowfin tuna | Other | TOTAL |
|---|---|---|---|---|---|
| 2021 | 0 | 0 | 0 | 0 | 0 |
| 2020 | 0 | 0 | 0 | 0 | 0 |
| 2019 | 0 | 1,918.99 | 382.92 | 0.78 | 2,302.69 |
| 2018 | 24 | 3,131 | 710 | 3 | 3,868.00 |
| 2017 | 0 | 3,270 | 1,648 | 4 | 4,928.00 |

Source: Oiterong and Sisior (2022)

Some clarification is required for the 2021 purse seine catch. As stated in the Palau report to the WCPFC, "There are no records as of yet for purse seine fishing in Palau waters in 2021". Similarly, (1) the FFA catch data (FFA 2022b) show that there were no purse seine catches in the Palau Zone in 2021 (there were 80 t in 2020), and (2) a table in Lewis et al. (2022) shows zero purse seiners operating in Palau waters in 2021.

For the purposes of the present study, it will be assumed that there were no purse seine catches made in the Palau EEZ in 2021. According to price data in FFA (2022b), the 1,314.92 t of longline catch (adjusted to the in-zone value[3]) is worth US$10,968,872.

## Freshwater catches

There are no major freshwater fisheries in Palau, but the larger islands of Palau (especially Babeldaob) have freshwater bodies that support edible freshwater fish and invertebrates. Jenkins (1999) reports 47 freshwater fish species, including four endemic and five introduced. Lake Ngardok, in Melekeok State on the island of Babeldaob, is the largest lake in Micronesia, with an area of approximately 0.18 square km (Anon. 2005). The longest river in Palau, the

[3] The values in FFA (2022) are values delivered at an Asian port, whereas the present study uses in-zone values (i.e. delivered values less the transshipment costs).

Ngerdorch River, drains from Lake Ngardok and flows 10 km to its mouth in Ngchesar State on the east coast of Babeldaob.

BMR staff indicate that eels and shrimp are the most important of the edible freshwater animals. The consumption of eels by Palauans is minimal due to cultural attitudes, but Filipinos resident in Palau are thought to eat eels occasionally. A small amount of freshwater shrimp is taken and consumed (H. Renguul and S. Victor, per. com. September 2015).

For the purposes of the present study, annual freshwater fisheries production in Palau in recent years is taken to be 1 t, worth US$10,000.

## Aquaculture harvests

The Micronesian Mariculture Demonstration Center (later renamed the Palau Mariculture Demonstration Center [PMDC]) was established in Palau in 1972. The culture of a large number of organisms has been attempted in Palau over four decades, both at the centre and independently.

A recent regional review of aquaculture (IAS 2022) commented on aquaculture in Palau:

- Current species cultivated commercially: Biota is an aquarium fish business, dealing with ornamentals, corals and clams. Based at the Airai Old Dock. Clams and corals for aquarium trade from old Taiwanese hatchery which fell into disrepair and now renovated. Clams & others exported to USA by air. Unaffected by Covid.
- Current species used for food security & small-scale community based production: Small farms primarily raise mangrove crabs, rabbitfish and milkfish. Rabbitfish through the communities but it stopped due to Covid.
- Other species attempted or planned: Species which have been trialed in Palau include seaweed, corals, giant clams, crocodiles, milkfish, mollies, mullet, oysters, shrimp, rabbitfish, sponge, trochus and turtles.

Recent Palau surveys and anecdotes provide some information on aquaculture in the country:

- The 2021 Palau Statistical Yearbook (BBP 2022) has information on the exports of giant clams. It states that the number of giant clams exported for commercial purposes was 1,619 in 2021, 3,631 in 2020 and 1,877 in 2019.
- The 2020 Palau census (OPS 2021) gives the number of households involved in aquaculture in the country: raising giant clam (32 households), raising milkfish (4) and other aquaculture (8).

- The recent ban on the exports of reef fish from Palau does not affect any aquaculture exports (K. Sisior, per. com. October 2022).

Lewis et al. (2022) comment on the impacts of Covid on aquaculture in Palau:

> The reduced flights impacted the milkfish farms and other aquaculture businesses that rely on feed and fry from abroad via plane cargo. While the two major milkfish farms in Palau provided bait to the Taiwanese fishing vessels, they also sold a large portion of their large fish to local customers. Their customer base could have sustained their businesses if it were not for the inability to get feed and fry shipped via plane cargo.

Much of the current aquaculture production of Palau is for the aquarium trade. McCoy (2020) provides a chronology of the development of the trade (Box 13-3).

**Box 13-3:** History of the aquarium products trade in Palau

- Giant clam production has been operational in Palau since the early 1970s, when the government opened the Micronesian Mariculture Demonstration Center (MMDC), now the Palau Mariculture Demonstration Center (PMDC). For many years, giant clam culture has been Palau's most important aquaculture activity, both for income generation and food security.
- Technology for clam mass production was developed in the early 1980s at the center with support from the Pacific Fisheries Development Foundation and the US Dept of Interior's Office of Technical Assistance. By 1994, it had become the world's oldest and largest giant clam hatchery.
- MMDC began regular shipments of juvenile clams to aquarium wholesalers in Los Angeles, Chicago and Miami in 1987. By 1989, MMDC was making monthly or twice-monthly shipments, grossing about USD 30,000 per year on sales to the aquarium trade.
- Exports of aquarium products from Palau were started by a locally owned company in 1991.
- During the early and mid-1990s, the subject of collecting aquarium products in the wild for aquarium use became contentious, partly driven by the development and expansion of the tourism industry.
- In 1996, Regulations on the Collection of Marine Resources for Aquaria and Research were formulated by the Ministry of Resources and Development and became effective.
- Palau became a signatory of CITES in 2004.
- One company, Watson Mariculture, has operated a private giant clam and marine ornamental farm since at least 2008. In 2012–2013, it exported some clams to MMME in Kosrae for onward sale on world markets. Watson Mariculture ceased the commercial culture of giant clams a few years ago and since then concentrates on soft corals and other invertebrates.
- A second private company, BIOTA Palau, is engaged in the culture and export of cultured aquarium fish, clams and corals.
- According to one published report, there were apparently from five to ten small companies producing four different species of giant clams in 2015.
- The original facilities at PMDC were demolished, commencing in October 2017 and a new facility was built with aid from Japan. The new facility was handed over in September 2018 and is now open and actively raising clams for distribution to farmers in Palau. An expert from Japan provided by Japan's Overseas Fisheries Cooperation Foundation assists clam mariculture efforts at the center.
- In 2019 the Palau Mariculture Demonstration Center provided five large *T. gigas clams* (2 ft in diameter) that were air-freighted to FSM. Four clams survived the trip and are now being used as broodstock in Kosrae. The arrangement between the Palau and FSM governments that facilitated the transfer includes regular reporting by FSM on the growth status and other information relating to the clams.

With respect to aquaculture production data, Palau is like many other Pacific Island countries in that obtaining information on the volume and value of aquaculture products produced is surprisingly difficult. During the short time spent in Palau for the present study[4], discussions were held with BMR staff and other fishery stakeholders, and a literature review was undertaken to get an idea of Palau's aquaculture production in 2021.

In a regional study of the aquarium products trade (McCoy 2020b), there is some information about the culturing of aquarium products in Palau. Two substantive companies in Palau culture items for the aquarium trade, including corals, clams and finfish. The report notes that all exported aquarium fish and soft corals have been cultured and none are captured in the wild. The report indicates that the price paid to local farmers for aquarium clams for export ranges from US$6 to $10. In 2018 the volume of aquarium products exported was estimated to be 1,300 pieces of hard coral, 8,000 pounds of live rock, 8,000 pieces of soft coral and 2,514 pieces of giant clam. The study used the 2018 export number of pieces and crude estimates of value per piece to obtain a free-on-board (FOB) value of aquarium exports in 2018 of around US$310,000. That value can be reduced by 30% to obtain a farm gate value (i.e. what is used in the present study) of US$217,000.

Other information relevant to estimating volumes and values of aquaculture obtained during the present survey include:

- BMR staff report "lots of giant clams from very small farms".
- There were two milkfish farms in Palau, but because they relied on fry from the Philippines and Taiwan, they stopped production during Covid due to lack of air cargo service.
- As stated above, the 2021 Palau Statistical Yearbook (BBP 2022) indicates that in 2021 a total of 1,619 giant clams were exported for commercial purposes.
- The 2018 Marine Export Report compiled by the BMR Coastal Fisheries Division shows that a total of 20,535 aquarium fish and soft corals were exported for commercial purposes to the United States in 2018.
- BMR staff report some culture of rabbitfish, which in 2021 was about 2,000 pounds (907 kg), with a farm gate value of US$4 per pound (US$8.16 per kg) for a 2021 total of US$7,401.
- Small or experimental amounts of other species are cultured by private operators or the Palau Mariculture Demonstration Center, including tiger shrimp, sea cucumber and mud crabs.

[4] Two working days were planned, but due to a declared national emergency, the time was reduced to one day.

As a guide, the volumes and values in a past study on Palau aquaculture may be useful. A previous Benefish study (Gillett 2016) made a crude estimate of Palau aquaculture production for 2014: (1) 22 t of milkfish plus 327,800 individual fish, worth about US$200,000 at the farm gate; and (2) 16,000 pieces of giant clams (for both the aquarium and restaurant trade), worth US$85,000 at the farm gate – equating to a total 2014 aquaculture production of 22 t and 343,800 pieces, worth US$285,000.

The above heterogenous array of facts and anecdotes is obviously inadequate for making an estimate of aquaculture production. Nevertheless, an educated guess of the 2021 production of aquaculture in Palau is 11 t and 4,419 pieces, with a farm gate value of US$89,000.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values[5] of the fishery and aquaculture harvests in 2021 can be made. (Table 13-5).

**Table 13-5:** Annual fisheries and aquaculture harvest in Palau in 2021

| Harvest sector | Volume (t and pcs, where indicated) | Value (US$) |
|---|---|---|
| Coastal commercial | 1,000 | 5,510,000 |
| Coastal subsistence | 1,400 | 5,399,800 |
| Offshore locally based | 41 | 395,250 |
| Offshore foreign-based | 1,315 | 10,968,872 |
| Freshwater | 1 | 10,000 |
| Aquaculture (pcs and t) | 11 t and 4,419 pcs | 89,000 |
| **Total** | **3,768 t and 4,419 pcs** | **22,372,922** |

The methodology used to estimate the production of coastal fisheries (both commercial and subsistence) and aquaculture is quite weak.

[5] The values in the table are dockside/farm gate prices, except in the case of offshore foreign-based fishing, where the value in local waters (overseas market prices less imputed transshipment costs) is given.

Figures 13-1 and 13-2 show the volumes and values of Palau fisheries production in 2021. Aquaculture is not shown on the volumes figure due to the use of mixed units (pieces and tonnes).

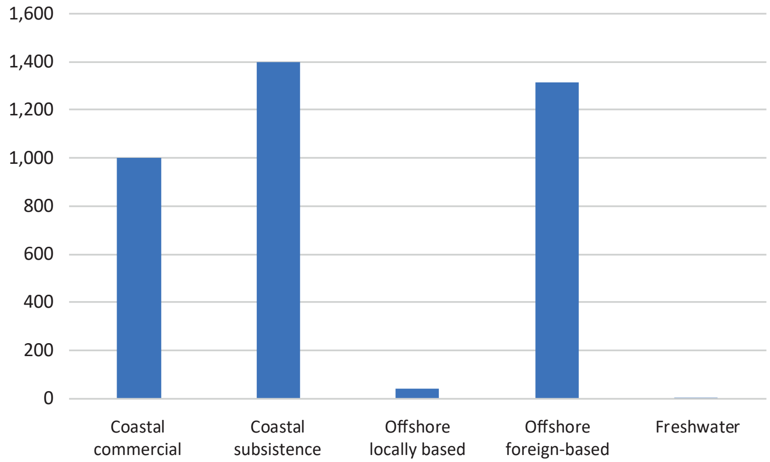



**Figure 13-1:** Palau fisheries production in 2021 by volume (t)

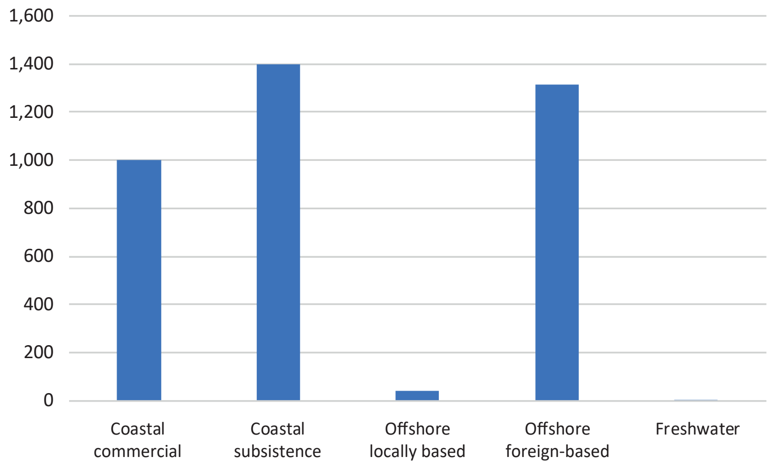



**Figure 13-2:** Palau fisheries production in 2021 by value (US$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and

Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for Palau from those four studies are provided in Table 13-6.[6]

**Table 13-6:** Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (US$) |
|---|---|---|---|
| Coastal commercial | 1999 | 865 | 2,595,000 |
| | 2007 | 865 | 2,843,000 |
| | 2014 | 865 | 3,200,000 |
| | 2021 | 1,000 | 5,510,000 |
| Coastal subsistence | 1999 | 1,250 | 2,500,000 |
| | 2007 | 1,250 | 2,511,000 |
| | 2014 | 1,250 | 3,300,000 |
| | 2021 | 1,400 | 5,399,800 |
| Offshore locally based | 1999 | 2,500 | 12,500,000 |
| | 2007 | 3,030 | 13,779,656 |
| | 2014 | 3,987 | 31,471,000 |
| | 2021 | 41 | 395,250 |
| Offshore foreign-based | 1999 | 124 | 270,000 |
| | 2007 | 1,464 | 4,947,496 |
| | 2014 | 4,017 | 18,555,070 |
| | 2021 | 1,315 | 10,968,872 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 1 | 8,000 |
| | 2014 | 1 | 10,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 3,100 pcs and 2 t | 50,000 |
| | 2014 | 343,800 pcs and 22 t | 285,000 |
| | 2021 | 4,419 pcs and 11 t | 89,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies represents a real change in production in some cases, but this can also represent a change in the methodology used for measuring production (hopefully, an improvement). In the table above the volume of production for coastal

[6] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

commercial, coastal subsistence and freshwater did not change between the years. This is because there have been no new data on production and no anecdotal information suggesting significant changes in production. In contrast, changes in production figures in the table for the offshore fisheries (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 13.2 Contribution of fishing to GDP

### Current official contribution

The official contribution of fisheries to nominal GDP is given in Table 13-7.

Table 13-7: The fishing contribution to GDP (US$ millions)

| | FY 2018 | FY 2019 | FY 2020 [7] | FY 2021 [8] |
|---|---|---|---|---|
| Fishing contribution to GDP | 5.3 | 5.1 | 4.4 | 4.3 |
| Palau GDP (purchaser price) | 284.9 | 278.9 | 251.9 | 217.8 |
| % fishing of Palau GPD | 1.9% | 1.8% | 1.7% | 2.0% |

Source: BBP (2022)

### Method used to calculate the official fishing contribution to GDP

The Graduate School USA, Pacific Islands Training Initiative (Graduate School) has for many years supplied much of the technical assistance to Palau and other Micronesian countries on national accounts and GDP estimations. An individual at the Graduate School kindly provided explanations on the methodology used to calculate GDP (G. McKinlay, per. com. September 2015 and November 2023):

- The basic methodology used by the Graduate School for estimating GDP has not changed between the previous Benefish study (focusing on 2014) and the current Benefish study (focusing on 2021).
- For the GDP estimation, the fishing sector is divided into (1) fishing coastal fish, (2) aquaculture and (3) fishing support services. In this methodology, value added from the foreign-owned locally based fishing vessels is excluded from the Palau GDP (i.e. not included as part of the Palauan economy), but the shore-based services of the companies providing support to the vessels is included in the Palau GDP.

[7] Revised
[8] Provisional figure

- In terms of the sources of the information for the fisheries components of GDP, the Graduate School uses:
  - o Aquaculture: from the social security and taxation databases
  - o Fishing support services: from trade database
  - o Fishing coastal fish: from Gillett (2009a)
  - o Fishing coastal non-fish: from trade database
  - o Subsistence: from Gillett (2009a)

### Alternative estimate of fishing contribution to GDP

Table 13-8 (below) represents an alternative to the official method of estimating fishing contribution to GDP in Palau. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 13.1 above (summarised in Table 13-5) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is the strategy of the present study to assume that the 2021 locally based longliner operations are not part of the Palau economy for GDP purposes. If for some reason agencies in Palau have reason to disagree with this concept, the volumes and values of those catches (and associated contribution to GDP) can easily be adjusted.

It is not intended that the approach in Table 13-8 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

Table 13-8: Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (US$, from Table 13-5) | VAR | Value added (US$) |
|---|---|---|---|
| Coastal commercial | 5,510,000 | 0.70 | 3,857,000 |
| Coastal subsistence | 5,399,800 | 0.80 | 4,319,840 |
| Offshore locally based | 395,250 | 0.20 | 79,050 |
| Freshwater | 10,000 | 0.95 | 9,500 |
| Aquaculture | 89,000 | 0.60 | 53,400 |
| **Total** | **11,404,050** | -- | **8,318,790** |

Source: This chapter and VARs from Appendix 3

In the above estimate, for calendar year 2021 the fishing contribution to GDP of US$8,318,790 represents about 3.8% of the financial year (FY) 2021 US$217.8 million GDP of Palau – whereas in the official contribution, it is much smaller (2.0%).

It is likely that the main difference is that the alternative calculation uses a much larger gross value for coastal fisheries production (both coastal commercial and coastal subsistence) than the official calculation.

## 13.3 Exports of fishery production

Recently, there have been two types of bans on the export of fishery products from Palau:

- The Palau National Marine Sanctuary Act called for all catches to be landed in Palau and effectively prohibited exports of pelagic fish, with the exception of those catches by free school purse seine vessels. Amendments to the Act passed in June 2019 expanded the export ban exemption to include longline vessels (Dacks et al. 2020).
- In April 2020 the president of Palau signed a law which banned the export of any living resource that primarily inhabits the reef areas, territorial sea and internal waters of Palau (letter from the President of Palau to the President of the Palau Senate).

In considering Palau fishery exports, it is important to consider the non-commercial exports. The Dacks et al. study (2020) found that the amount of coastal fish exported is 10.1 t commercial and 104.8 t non-commercial. That study gives information on the “cooler trade” (Box 13-4).

**Box 13-4:** The cooler trade

Given traditional practices and food customs, unsurprisingly, a large volume of reef fish is consumed by Palauan residents, of which approximately half is non-commercial. There are two interesting, policy-relevant non-commercial flows that are highlighted here. First, the non-commercial export of reef fish is large, with estimates of 104.8 mt being exported through what is commonly known as the "cooler trade," or the exporting of marine resource filled coolers as baggage during airline travel. Notably, the cooler trade is greater than the upper estimate of tourist reef fish consumption (84.9 mt). Currently, airline passengers are restricted to 50 lbs of marine resources each. Additional policy measures that limit the number of annual personal allowances per year and/or that place a tax on exports for personal use may help to limit the volume of non-commercial reef exports, while still allowing for some amount of non-commercial trade. Sharing of resources, such as fish, is significant in Pacific Island culture and important for maintaining social networks that span across the Pacific and beyond. An outright ban on the non-commercial export of fish may degrade social capital if it disturbs reciprocal exchange.

Source: Dacks et al. (2020)

There are two systems of monitoring the fisheries exports of Palau:

1. There is a permit system operated by the Bureau of Fisheries, which gives weights and numbers of fish in two categories, commercial and non-commercial (both by species). The weights of exports are given in Table 13-9.
2. The Palau Bureau of Customs and Border Protection keeps track of all exports of Palau, including fishery export. They are the values of the Harmonized System (HS) 03 category: "Fish and crustaceans, molluscs and other aquatic invertebrates". The values of exports are given in Table 13-10.

**Table 13-9:** Volume of fishery exports of Palau (pounds)

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Commercial | 24,685 | 21,696 | 4,158 | 0 |
| Non-commercial | 200,000 | 202,491 | 40,000 | 21,135 |
| **Total** | **224,685** | **224,187** | **44,158** | **21,135** |

Source: BBP (2022)

Table 13-10: Value of the fishery exports of Palau (thousands of US$)

| | HS 03 exports | Total exports | HS 03 as % of total exports |
|---|---|---|---|
| 2017 | 1,291 | 6,420 | 20.11 |
| 2018 | 813 | 4,481 | 18.15 |
| 2019 | 139 | 4,292 | 3.23 |
| 2020 | 340 | 6,747 | 5.04 |
| 2021 | 319 | 1,951 | 16.34 |

Source: Kindly compiled by N. Lal of SPC/SDD

If the 21,135 pounds (9,586 kg) of fishery exports in 2021 (both commercial and commercial) is valued at the market price of US$6.89 per kg (given in a section above), the total market value from the Bureau of Fisheries export monitoring in 2021 is US$66,051. With a 25% addition for an FOB value, this would be $82,563 – considerably less than the US$319,000 recorded through the Bureau of Customs systems. This is consistent with the observation in many Pacific Island countries that customs departments are better at tracking values of fisheries exports, with fishery departments better at identifying and tracking individual species.[9]

## 13.4 Government revenue from fisheries

### Access fees for offshore fishing

In the recent past, Palau has received money for fishing in its waters under various arrangements. These include fees from the locally based foreign longline vessels, the Japanese agreement covering three types of tuna fishing by vessels based in Japan (longline, pole-and-line and purse seine), the U.S. multilateral tuna treaty, the Federated States of Micronesia Arrangement, the Parties to the Nauru Agreement (PNA) purse seine vessel day scheme, and most recently, the PNA longline vessel day scheme. The report to WCPFC (Oiterong and Sisior 2022) states that in 2021 Palau licensed one domestic-based foreign flagged longline vessel.

Table 13-11 (below) gives all the access fees received by Palau in recent years from the various types of offshore fishing activities.

[9] The Bureau of Fisheries export data is broken down into 30 species groups, with the table here only showing the summary.

**Table 13-11:** Access fees (US$ millions) compared to total government revenue (%)

| | Fees from longlining | Fees from purse seining | Total fees (for calendar year) | Total government revenue (for FY) | Access fees as % of total government revenue |
|---|---|---|---|---|---|
| 2015 | 0.78 | 6.72 | 7.50 | 114.864 | 6.5% |
| 2016 | 0.98 | 5.79 | 6.77 | 124.701 | 5.4% |
| 2017 | 1.43 | 9.20 | 10.63 | 114.962 | 9.2% |
| 2018 | 1.31 | 8.84 | 10.16 | 126.733 | 8.0% |
| 2019 | 1.26 | 9.09 | 10.36 | 119.421 | 8.7% |
| 2020 | 0.51 | 8.06 | 8.57 | 127.757 | 6.7% |
| 2021 | 0.25 | 7.61 | 7.87 | 112.894 | 7.0% |

Source: Modified from Lewis et al. (2022) and BBP (2022)

It should be noted that some of the fees that Palau received from purse seining came from fishing in waters outside those of Palau. This is because there is a feature in the PNA purse seine vessel day scheme (but not in the longline vessel day scheme) which allows a participating country to both transfer and pool purse seine days to other participating countries, depending on where the purse seine fishing is concentrated. Consequently, the revenue earned by Palau from purse seining is not limited to fishing within the Palau EEZ. As stated by Lewis et al. (2022): "Overall, Palau's offshore fishing revenues come principally from the purse seine vessels day scheme and have little to do with the amount of fishing in Palau's water as Palau sells most of its days to other countries or to companies that fish in other EEZs."

## Other government revenue from fisheries

The other significant source of direct government revenue from fisheries activities is the fish export tax. It should be noted that some fisheries specialists consider the fish export tax to be a form of access fee. During the period 1999–2007, there was a tax of US$0.25 per kg of fish landed by longliners in Palau, irrespective of quality or marketing destination (for example, sashimi grade for air export, bycatch species and reject tuna). In 2008 the tax rate was increased to US$0.35 per kg, and in 2020 it was increased to $0.50 per kg. According to Lewis et al. (2022), the tax resulted in revenue of $819,153 in FY 2017, $765,417 in FY 2018, $584,544 in FY 2019 and $157,463 in 2020.

- According to BMR (2018), other sources of revenue from the fisheries sector include: An annual management fee for offshore fishing vessels ($600 per vessel per year).
- Marine Export Declaration (MED) fee: citizen (US$5), non-citizen (US$10), commercial (US$25) and scientific research (US$25). In 2017, $32,830 in MED fees was collected.

- Convention on the International Trade of Endangered Species (CITES) permit: non-commercial (US$5), commercial (US$25) and scientific research (US$25). In 2017, $1,860 was collected in CITES permit fees.
- Marine Research Permit: $8,100 was collected in research fees for 2017.
- Fishing license fees and fishing boat registration fees are charged by some of the states of Palau.

## 13.5 Fisheries-related employment

The 2020 census contains some information on employment in fisheries (OPS 2021). Unfortunately, much of the employment-relevant data are aggregated with jobs from other sectors. For example, in 2020 there were 337 "Skilled Agricultural, Forestry & Fishery Workers". Information in the census that is specific to fisheries-related employment includes the following:

- Of the 5,056 households in Palau, 1941 (38%) participate in fishing.
- Of the 5,056 households in Palau, 46 (0.9%) participate in aquaculture.

The Palau 2021 Statistical Yearbook (BBP 2022) contains census information that show the evolution of participation in fisheries over two decades:

- 2004: 933 people participate in fishing (6.3% [sic] of people over 16 years of age)
- 2014: 1,804 people participate in fishing (44% of people over 16 years of age)
- 2019: 428 people participate in fishing (45% of people over 16 years of age)

The 2014 Palau HIES (OPS 2015) shows that 249 households in Palau (4.2% of all households) reported receiving some cash income from fishing.

Much of the above information appears to be about informal employment in the fisheries sector. Records from Palau's Social Security Administration (which is presumably about formal wage-paying employment related to fishing) are used to construct Table 13-12.

**Table 13-12:** Formal employment in the fisheries sector

| | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 |
|---|---|---|---|---|---|
| Number of fishing workers | 92 | 91 | 85 | 60 | 35 |
| Total number of workers | 11,735 | 11,766 | 11,440 | 10,980 | 9,763 |
| Fishing workers as a % of total workers | 0.8% | 0.8% | 0.7% | 0.5% | 0.4% |

Source: Graduate School (unpublished data)

It is evident from the above information that the number of formal fishing jobs is quite small compared to informal participation in fishing, and they are declining in number – which is likely to be related to the establishment of the Palau National Marine Sanctuary.

To elucidate how women and men differentially use and manage marine resources in Palau, Singeo et al. (2021) conducted a nationwide survey in Palau of 365 women and 382 men in 12 of Palau's 16 states. Box 13-5 summarises the results.

**Box 13-5:** Gender aspects of fishing in Palau

Among those who self-identified as fishers or gleaners, 67% of fishers were men and 85% of gleaners were women. This reflects a gendered division of marine resource use with a long history in Palau. Yet the vast majority of the fisheries literature in Palau has focused on finfish, meaning women's roles in fisheries have been widely underreported. Gleaning is significant to Palauan women not only for food and income, but also for cultural and social practices. Both women and men fish in Palau, using many different methods. Men dominate finfish fishing, especially spearfishing and net fishing. Fishing is an important and popular activity in Palau, with the majority of people regularly engaging in fishing for subsistence, income, recreation, and/or cultural practices. Across the entire sample, we found that 70% of people in Palau had done some kind of fishing in the past year, including gleaning. Men were more likely to have participated in fishing activities, though both women and men were highly engaged, with 84% of men and 56% of women reporting some kind of fishing in the past year. Among finfish fishers, the most popular fishing method for both women and men was bottom line fishing.

The major conclusions of the study:

- Both women and men in Palau rely heavily on marine resources for food, income, recreation, and cultural practices.
- While women tend to dominate nearshore invertebrate fisheries such as clams and sea cucumbers, men tend to dominate higher-value fisheries for reef fish, sea turtles, lobsters, and mangrove crabs.
- Palauans agree that women and men have different knowledges of marine environments, and that both women and men should be involved in managing marine resources.
- Women and men are both central to intergenerational ecological knowledge-sharing, and there is a need to expand the transfer of marine ecological knowledge to youth, especially girls.

## 13.6 Levels of fishery resource consumption

The historical estimates of fishery resource consumption include:

- Preston (2000) used 1995 FAO production, import and export data to estimate an annual per capita fish consumption in Palau of 85 kg.
- PCS estimated: (1) local coastal production of 2,115 t, (2) fishery product imports of 610 t, (3) fishery product exports of 400 t, (4) a mean resident population in Palau in the 1990s of 16,600, and (5) visitors to Palau (full-time resident equivalents) of 500. This equates to an annual per capita fishery product consumption of 135 kg (PCS 2000).
- Gillett (2009a) updated the above PCS estimation with new estimates of population and local consumption of the production from offshore fisheries: (1) SPC (2008) indicated that the mid-2007 population of Palau was 20,162; (2) BMR unpublished data shows that in 2007, "local sales and donations" of tuna and billfish from the locally based longline fleet was 216,789 kg; and (3) assuming other factors are similar to those of the PCS study, the annual per capita fishery product consumption of whole fish equivalent was 123 kg in 2007.
- The SPC Pacific Regional Oceanic and Coastal Fisheries (PROCFish) project surveyed four locations in Palau that were representative of the country in terms of fisheries conditions (Friedman et al. 2009a). In terms of fish consumption (fresh fish, invertebrates and canned fish), the annual per capita results were as follows: Ngarchelong – 73.1 kg, Ngatpang – 72.0 kg, Airai – 81.7 kg, and Koror – 86.8 kg; representing an average of 78.4 kg across the four sites.
- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. For all of Palau, the annual per capita fish consumption (whole weight equivalent) was 33.4 kg, of which 78% was fresh fish. For rural areas, the figure for per capita consumption of fish was 43.3 kg, and for urban areas it was 27.8 kg. The following should be noted with respect to these results:

Wabnitz et al. (2018) highlight an important current issue in fish consumption in Palau:

> While climate change had the largest expected impact on local ecosystems, reef fish consumption contributes considerably to future projected declines in marine resources. For Palau to achieve its goals of boosting revenues while sustainably stewarding marine resources, it will be necessary to transfer some level of consumption from reef fish on to tuna and other pelagics. Such changes, which align with the current proposal of developing an offshore national fishery as part of the Sanctuary's management plan, may allow Palau to meet future seafood demand, while protecting reef systems and the industries that rely on them.

Presently, there seems to be a fair amount of current enthusiasm in Palau that small-scale fishing for tuna and other pelagics can make up for the loss of fish from the departed longline fleet. Forty years of efforts to develop small-scale tuna fishing in Palau and neighbouring Pacific Island countries show that this is not an easy process, and that agencies promoting such development should be aware of the many mistakes that have been made in the past (Gillett et al. 2018).

## 13.7 Exchange rates

Palau uses the US dollar (US$).

# 14 Papua New Guinea


## 14.1 Volumes and values of fish harvests in Papua New Guinea

### Coastal commercial catches in Papua New Guinea

The 2017 Roadmap for Coastal Fisheries and Marine Aquaculture by the National Fisheries Authority (NFA 2017) lists the main coastal fishery resources utilised by coastal and island communities in Papua New Guinea (PNG) as:

- Sea cucumbers for the production of bêche-de-mer
- Shells for button-making, mostly trochus and some green snail
- Shell meat, mostly giant clams, trochus and various other edible shellfish
- Shells for sale to tourists, either as whole shells or processed into jewellery
- Shells for the production of traditional custom valuables (most common being shell money)
- Other coastal invertebrates
- Reef fishes
- Coastal pelagic fish
- Sharks, mostly targeted for their fins
- Estuarine fishes, including barramundi

- Deep-slope fish, notably snappers and groupers
- Crustaceans, mostly mud crabs, prawns and lobsters
- Marine plants and algae
- Ornamental fish for export for the aquarium trade
- Corals that are harvested for the production of lime to chew betel nut

Small-scale commercial fishing for non-perishable, high-value export commodities has historically been quite important. In contrast, commercial catches of finfish for domestic markets appear surprisingly small relative to the country's population and resource endowment. This reflects limited market opportunity, logistical issues in delivering, and a culture where commercial trade in customary communities is driven by short-term cash needs, rather than a need or desire to participate in the cash economy (M. Brownjohn, per. com. March 2023). Over two decades ago, Preston (1996a) stated that the commercial development of small-scale coastal fisheries has been viewed as a means of generating rural earnings and other social and economic benefits and has been a government target in PNG for nearly 45 years, but that success has been elusive. Barclay and Kinch (2013) explore this issue:

> Why have cash-earning food fisheries not taken off in most rural coastal and island areas in PNG and the Solomon Islands to date? The main reason would appear to be that such fisheries are usually not profitable without high external inputs. Unlike high-value, easy-to-store-and-transport shells and dried marine products, fresh, chilled and frozen fish are low value to weight and are tricky to store and transport in good condition. The costs and difficulties involved in getting fish from rural areas out to markets, and getting fuel and mechanical repairs into rural coastal areas, usually outweigh the prices fetched by the fish. When project funding stops, therefore, the fisheries stop soon after.

The following describe some of the main historical attempts to estimate production from coastal commercial fisheries in Papua New Guinea:

- Dalzell et al. (1996), using information from the late 1980s and early 1990s, estimated that PNG's coastal commercial fisheries annually take 4,966 tonnes (t), worth US$22.1 million.
- Preston (1996) states that the annual commercial fisheries production in the mid-1990s was about 4,800 t, worth K16.4 million (PNG Kina [K]).
- Gillett and Lightfoot (2001) considered several sources of information for coastal commercial production for the years 1989–1991 and ventured an estimate of 5,500 t, worth K55 million.

- Gillett (2009a) examined the above studies and some more recent information. He ventured an estimate that coastal commercial fisheries production in the country in the mid-2000s was 5,700 t, worth K80 million.
- Gillett (2016) concluded that there was probably a moderate increase in the volume and value of coastal commercial fisheries production between 2007 (the focal year for the 2009 study) and 2014. Accordingly, the production from PNG coastal fisheries in 2014 was deemed to be 6,500 t, with a value of K130 million.

Knowledge of the production of coastal commercial fisheries in PNG is quite poor, except for commodities that are exported. Teh et al. (2014) describe the situation (Box 14-1).

**Box 14-1:** Coastal fisheries data

Fisheries data collection falls under the responsibility of the National Fisheries Authority, though there are plans to have Provincial Fisheries Officers collect catch and landings data. The need for establishing a comprehensive statistics collection system in PNG for effective fisheries management has been recognised for almost 40 years. Data for the tuna industry after 2001 is fairly reliable due to the implementation of effective catch logsheet and observer programmes. Unfortunately, the same level of reporting for artisanal fisheries is not regularly collected, except for aid donor projects, such as the Asian Development Bank project which conducted landing and market surveys in the New Ireland, Morobe and Milne Bay Provinces in the mid-2000s. Relatively reliable catch and export data exist for some inshore commercial fisheries such as sea cucumbers and trochus. Here, statistics on fisheries such as reef finfish, sea cucumber, lobster, and trochus only cover the quantity that is exported and not what is consumed locally. There are also large time series gaps in data, as trochus is not reported regularly while sea cucumber landings only started to appear in 1981 despite having been exported since the late 1800s. Finally, there is no accounting for small-scale subsistence fisheries, despite this sector's substantial importance to local wellbeing.

Source: Teh et al. (2014)

Although similar situations exist in most Pacific Island countries, the PNG coastal fisheries case is perhaps the most difficult to improve due to the size of the country, the number of coastal and island villages, and the isolation of many production sites.

NFA staff indicate there has been no recent research aimed at assessing the total production of PNG's coastal commercial fisheries. Consequently, the method used here is to modify the previous estimate for 2014 based on known changes that may affect fisheries production and various sources of recent information on the economically important coastal commercial fisheries.

The two main factors that are likely to have affected the production from PNG's coastal commercial fisheries are the impacts of Covid and the opening/closing of the sea cucumber fishery and the beche-de-mer trade. A senior manager at PNG's NFA comments on the impacts of Covid on coastal fisheries in the country (Box 14-2).

**Box 14-2:** The impacts of Covid on coastal fisheries in PNG

In Papua New Guinea, covid had minimal impact on the rural supply chain of fishery resources, as much of the covid-affected population were in the urban areas. The restrictions on movement of rural people were not so severe, still allowing consumers to move freely to the rural markets. Rural markets operated as normal and supply of fish to those markets continued as normal.

In contrast, the town or urban markets experienced low fish supplies during the covid pandemic simply because of the fear fishermen have on contracting the virus when in town or mixing with urban community. There was evidence of stockpiling by urban consumers, mainly for tin fish and the sale of fresh fish supplies at urban markets were suppressed as a result. Consequently, fishermen fishing into urban markets experienced loss of income, that had a domino effect on livelihood especially for medicines, clothing and basic necessities.

Source: L. Gisawa (per. com. October 2022)

The opening/closing of PNG's sea cucumber fishery has a major impact on coastal fisheries. According to the Executive Overview of the PNG Fisheries Sector (NFA 2022b), the value of the exports from this fishery approaches the export value of all other coastal fishery products combined. Leban Gisawa comments on the benefits from the fishery – and their irregular flow (Box 14-3).

**Box 14-3**: The intermittent benefits of the sea cucumber fishery

The fishery is the second biggest export earner for PNG after tuna and contributes US$50 million of export revenue and about US$27 million goes directly to coastal and island communities annually. The income generated from the beche-de-mer fishery going directly to men, woman and children in the coastal and island communities is highly significant – but the benefits are intermittent. The fishery was closed in 2009 for 7 years and 4 months and reopened in 2017 and 2018 and was again closed in 2019. In 2020 the fishery was reopened as a result of political directive in order to support the coastal and island communities' livelihoods which was marred by the impact of covid. Due to low levels of stock, the fishery was closed in 2021, a decision emanating from NFA board resolution, for 2 years to allow the stocks to recover. The fishery is presently closed.

Other factors that are likely to have affected the fisheries production from PNG's coastal fisheries in the period 2014 to 2021 are:

- The population of PNG increased from 7,816780 in 2014 to 9,122,994 in 2021, a 16.7% increase (SPC/SSD, unpublished data).
- The aquarium products fishery is no longer active. Although this export-oriented fishery was once substantial, there have been no recorded exports since 2016 (Gillett et al. 2020).
- Mud crab exports and fish maw exports grew exponentially (J. Kinch, per. com. March 2023).
- Fuel costs have generally declined moderately since 2014, with no major spikes in costs (Havice et al. 2021).

How can the above information be used to modify the 2014 estimate of coastal commercial fishery production? It seems reasonable to state that Covid probably had a substantial negative impact on those commercial fisheries oriented to PNG's cities and towns, and much less impact, if any, on those that fed into rural markets. The fact that the sea cucumber fishery was closed in 2021 is quite significant – but it was also closed in 2014 – so the production from that fishery can be disregarded in this exercise. Similarly, the lack of spikes in fuel costs (unlike earlier periods prior to 2014) largely eliminates the need to consider the impact of sudden changes in the cost of fuel. The 16.7% increase in the population of the country would tend to stimulate demand and coastal commercial production – but that is likely to be overshadowed, or least moderated, by the negative effect of Covid on urban fish marketing.

NFA staff indicated that the price of fish to fishers ('beach price") is about half of the market price.[1]

The information presented in this section is entirely inadequate for estimating the volume and value of coastal commercial fisheries production in PNG. The approach taken in the present study intended to take the Gillett (2016) estimate for 2014 and adjust it according to the relevant information in this section, but this method is plagued with uncertainty. For the purposes of this study, the coastal commercial production in 2021 is deemed to be 6,000 t, with a value to the producer of K66 million.

[1] Gillett (2016) assumed that the average fish price in non-urban markets was K7 per kg in 2014.

## Coastal subsistence catches

The following are the four estimates of coastal subsistence catches in PNG that are often cited:

- Dalzell et al. (1996), using information from the late 1980s and early 1990s, estimated that PNG's subsistence fisheries annually take 20,588 t, worth US$41,176,000.
- Preston (1996), using several sources, concluded that PNG's subsistence fisheries annually take 26,000 t.
- Gillett and Lightfoot (2001) considered the above two estimates and other information to venture annual estimates of 26,000 t in catch, worth K52 million.
- Gillett (2009a) considered the 2001 study (above) and the results of a 1996 household income and expenditure survey (HIES). He estimated the coastal subsistence production of PNG in the mid-2000s to be 30,000 t, worth K105 million.
- Gillett (2016) estimated coastal subsistence production in 2014 to be 35,000 t, worth K171.5 million to the fishers.

To some degree, some of the above estimates have been institutionalised. For example, NFA (2015) and NFA (2017) state: "annual coastal subsistence fisheries catches in PNG range from 20,600 to 30,000 tons."

A 2020 survey (WCS and LMMA 2020) on the impacts of Covid on 14 coastal villages in Central and New Ireland provinces in mid-2020 indicated:

- The majority of respondents did not note the COVID-19 pandemic or associated government restrictions as a major disturbance affecting their villages.
- Overall, there was no sign of net migration.
- Food availability is a challenge during the dry season, exacerbated by responses to the pandemic.
- There was an increase in both farming and fishing activities.
- Fishing pressure increased in the view of most women respondents, but male respondents believed fishing pressure has decreased.

In the above section on coastal commercial production, the national average price to fishers of fish and high value invertebrates was crudely estimated to be about K11 per kilogram. Using the farm gate method for valuing subsistence production, a value to subsistence producers of K7 is assumed.

As with the coastal commercial fisheries situation in PNG, the available information is highly inadequate for making an estimate of production from the country's subsistence fisheries. The only practical option for estimating current coastal subsistence production is to adjust previous estimates by the impacts of Covid and population change. Accordingly, the volume of the 2021 subsistence production is estimated to be 40,000 t, with a value to fishers of K280 million.

### Locally based offshore catches

The paper presented by the PNG delegation to the meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission (NFA 2022a) gives information on the PNG-based offshore fishery (Box 14-4).

**Box 14-4:** The PNG tuna fleet

The PNG tuna fishery is made up of both the purse-seine and longline sectors. The domestic longline vessels fish exclusively in PNG waters and until recently after more than two decades, PNG opened its waters to foreign longline vessels again. The purse-seine sector is made up of a mixture of both domestic and foreign access vessels. The domestic sector comprises the PNG flag vessels and the PNG locally-based foreign vessels which are under domestic charter arrangements to support onshore processing facilities in PNG. There were a total of 40 purse seine vessels in the PNG national fleet active in the WCPFC Convention Area in the year 2021. There were no domestic tuna longline vessels active inside PNG waters in 2021. There were however foreign tuna longline vessels fishing inside PNG waters in the year 2021. PNG purse seine vessels fish in the PNG waters as well as waters of other PNA member countries under the FSM Arrangement. During the peak El Niño condition in late 2015 activities of the purse seine vessels under the PNG national fleet shifted towards the East. In 2016, vessels' catch and effort were almost equally distributed between the West and the East. From 2017 onwards the fishing activities of the purse seine vessels under the PNG national fleet was more concentrated towards the west.

Source: NFA (2022a)

NFA (2022b) states that the domestic sector is comprised of PNG flag vessels and the PNG locally based foreign vessels which are under domestic charter arrangements to support onshore processing facilities in PNG.

With the readily available information, two assumptions are required in order to estimate the production volume of locally based offshore fishing (and the associated GDP contribution):

1. The "domestic sector" (for which catches are not given) equals the "PNG purse seine fleet", for which catches are given in NFA (2022a).
2. PNG flag vessels and the PNG locally based foreign vessels are all truly locally based – and therefore part of the PNG economy for GDP purposes.

If either of the two assumptions above is incorrect, then the information in this section (and in the GDP section) requires adjustment.

NFA (2022a) gives the catches of the locally based purse seine fleet (Table 14-1).

**Table 14-1:** Catches of the locally based purse seine fleet (t)

| | 2017 | 2018 | 2019 | 2020 | 2021 p |
|---|---|---|---|---|---|
| Albacore | 10 | 17 | - | 5 | 7 |
| Bigeye | 8,523 | 7,174 | 3,880 | 483 | 779 |
| Skipjack | 179,124 | 209,631 | 195,213 | 109,191 | 102,060 |
| Yellowfin | 118,847 | 94,694 | 66,296 | 70,839 | 67,910 |
| **Total [2]** | **313,466** | **319,006** | **265,389** | **180,518** | **170,755** |

Source: NFA (2022a); p = provisional

As there were no catches by locally based longline vessels in 2021 (NFA 2022a), the catches of the locally based purse seine fleet represent all the locally based offshore catches for the recent years.

The decline in catch post 2018 reflects the PNG flag seiners reflagging when they were required to pay the full vessel day scheme (VDS) price under the rebate scheme (M. Brownjohn, per. com. March 2023).

The effects of Covid and oceanographic conditions on the 2021 purse seine catches are noted:

- The Executive Overview of the PNG Fisheries Sector (NFA 2022b) indicates that despite the Covid pandemic, production from the processing plants (largely fed by the PNG domestic fleet) has consistently increased by 10% year on year from 2019–2021.
- The quarterly extent of the warm pool (i.e. surface water >28.5°C on average) in 2021 compared to the average for 2016–2020 shows that the La Niña conditions during 2021 restricted the warm pool to the western areas compared to the recent 5-year average (2016–2020). Relatively higher catches were taken in PNG in the 1st quarter of 2021 compared to the 2016–2020 average period, and there was high proportion of yellowfin tuna in the catches in and around PNG during the 4th quarter of 2021 (Williams and Ruaia 2022).

Using prices from the Forum Fisheries Agency (FFA 2022b), the 2021 purse seine catch of 170,755 t would be worth about US$256 million (K898 million)

[2] Three of the totals in this table appear to be incorrect, but they are left unchanged from the original document.

in Bangkok (i.e. US$1,500/t), but it is likely that the PNG processing facilities would pay less. A semi-arbitrary value of $1200/t is assumed. In summary, the 170,755-tonne locally based offshore tuna catch would have a PNG dockside value of K719 million.

## Foreign-based offshore catches

In recent years, the foreign-based offshore catches in the PNG exclusive economic zone (EEZ) were made by both purse seine and longline vessels. Tables 14-2 and 14-3 give the purse seine and longline catches, respectively.

**Table 14-2:** Catch of the foreign purse seiners in the PNG EEZ

| | Skipjack | Yellowfin | Bigeye | Total |
|---|---|---|---|---|
| 2017 | 68,592 | 17,778 | 1,186 | **87,556** |
| 2018 | 76,520 | 15,806 | 1,020 | **93,346** |
| 2019 | 64,616 | 13,683 | 973 | **79,272** |
| 2020 | 111,606 | 23,035 | 1,695 | **136,336** |
| 2021 | 127,946 | 27,799 | 3,281 | **159,026** |

Source: NFA (2022a); Units = tonnes

**Table 14-3:** Catch of the foreign longliners in the PNG EEZ

| | Albacore | Yellowfin | Bigeye | Total |
|---|---|---|---|---|
| 2017 | 17 | 333 | 203 | **553** |
| 2018 | 45 | 402 | 2,548 | **2,995** |
| 2019 | 647 | 1,339 | 7,704 | **9,690** |
| 2020 | 1 | 0 | 2 | **6** [3] |
| 2021 [p] | 364 | 1,534 | 210 | **2,107** |

Source: NFA (2022a); p = provisional; Units = tonnes

The impact of Covid on the 2020 longline catch is apparent. This was due to markets in Japan and the United States being closed.

Using pricing information in FFA (2022b) and adjusting for in-zone prices (FFA prices are at destination markets), the in-zone value of the 2021 purse seine catch is estimated to be K675 million. The in-zone value of the 2021 longline catch (after adjusting for the value of the bycatch) is estimated to be K57 million. The total catch (purse seine and longline) is estimated to be 161,133 t, with an in-zone value of K732 million.

[3] This total is incorrect, but it is left as in the original document.

## Freshwater catches

Coates (1996) describes the major features of the freshwater fisheries in PNG:

- Over 87% of the human population of PNG live inland and have no direct access to marine aquatic resources.
- Even in highland areas of Papua New Guinea where fish stocks are very poor, over 50% of the population engage in fishing activities in many areas, traditionally for eels, but more recently, catches include a number of exotic species.
- Commercial exploitation of freshwater fish in Papua New Guinea is limited: southern flowing rivers support a small barramundi (*Lates calcarifer*) fishery, although this has recently declined; modest amounts of freshwater prawns are landed seasonally, estimated at no more than 10 t per year.

Fish maw exports have grown exponentially. The main economic activity is the trade in fish maw (swim bladder trade) from croaker/jewfish (*Nibea squamosa*), which can afford very high prices. Other species, such as threadfin salmon, barramundi, eel-fish and catfish, are also sporadically purchased depending on market demand (J. Kinch, per. com. March 2023).

The Fly River system in PNG's Western Province is the largest river in the country and has the most diverse freshwater fish fauna in Australasia (Swales 2000). Box 14-5 describes the river and its fisheries.

**Box 14-5:** The fisheries of the Fly River

The first systematic survey of the fish populations of the Fly River was carried out in the mid-1970s by T.R. Roberts, who discovered that the fish populations in the Fly are characterised by the large size of some species, the abundance of endemic species and the dominance by groups that are poorly represented in other parts of the world. The Fly River system was found to support the most diverse fish fauna in the Australasian region, with 128 recorded native freshwater species representing 33 families. Seventeen species are known only from the Fly basin, and thirty or more are known only from the Fly River and one or more of the large rivers in central-southern New Guinea. The total catch from both areas reached 330 tons year in the early 1970's, but the commercial fishery on the coast ceased operation in 1990 because of declining catch rates.

The primary human use in the aquatic ecosystem is the subsistence fishery, which forms part of the traditional way of life of villagers living along the river. Most fish are consumed by the villagers, with catfish being the preferred species, compared to barramundi and black bass in the commercial fishery. It has been estimated that the current use is 416 tons/year, assuming a weekly fish intake of 2 kg/person and a population size of 4,000 people. Based on data released in March 1999, there are now estimated to be 5,000 people living along the middle Fly River, resulting in a new fish yield estimate of 520 tons/year. These estimates do not account for by-catch that is not used or the commercial barramundi and bass fishery. Assuming that by-catch equals 10 percent of the fish consumed and that the commercial barramundi and bass fishery is responsible for approximately 36 tons/year, the estimated yield based on the combined artisanal and commercial fishery is approximately 600 tons/year.

Source: Swales (2000)

The following summarises information about aspects of the freshwater fisheries in PNG:

- *Tilapia niloticus* has escaped into the Fly River and may have increased the productivity of the river. (J. Wani, per. com. August 2015)
- Carp were introduced to the Telofomin area in the 1990s and escaped into the Fly River system. They were reported at Obo in about 2000 (M. Brownjohn, per. com. January 2016).
- There was a major Food and Agriculture Organization (FAO) project to introduce new freshwater fish to the Sepik–Ramu river system in the early 1980s (Coates 1987). The impacts of that initiative are not yet known (J. Wani, per. com. August 2015), but numerous anecdotal reports suggest some species have thrived (A. Lewis, per. com. January 2016).

- Recreational fishing of black bass is becoming important in the country and is receiving considerable international attention (Martin 2015).

The current average price of fish at inland fish markets is variable, but for the purposes of this study, K8 per kg will be taken as an average price.

As with the situation for coastal fisheries, there is scant helpful information in PNG for making an estimate of annual production from freshwater fisheries. Preston (1996a) makes an educated guess of 13,500 t annually, and this amount is often cited. Gillett (2009a) and (Gillett 2016) took the Preston amount and increased it to account for population growth. With little alternative, the present study assumes that the 2021 PNG freshwater fishery production is that of the Gillett (2016) study, increased by the amount that the country's population grew in the period 2016–2022 (i.e. a 16.7% increase). That equates to about 23,000 t of freshwater fish per year. Assuming that the average fish price in inland markets was K8 per kg in 2014, using the farm gate system of valuation, a value of K5.60 per kg can be assigned to subsistence freshwater catches.

A crude estimate of the production of freshwater fisheries in 2021 is 23,000 t, with a farm gate value of K129 million.

### Aquaculture harvests

A recent regional review of aquaculture (IAS 2022) commented on aquaculture in PNG:

- Current species cultivated commercially: Barramundi at Daru in Western Province. Hatchery established. Collapsed but is being regenerated with outside investors.
- Current species used for food security and small-scale community-based production: Tilapia – widely throughout the country. Mostly back yard production with some larger semi-commercial produces. Numbers of farmers and production figures are very hazy (figures for numbers of farmers vary between ~6000 to ~20,000), but undoubtedly much more than generally reported. GIFT tilapia introduced. NFA hatchery in New Ireland Training Centre is doing tilapia now, and training in aquaculture. Brown & rainbow Trout – concentrated in the highlands. Widespread. Polyculture with carps. Rainbow trout released into streams. Total Aquaculture production is given by World Bank as 6001 tonnes in 2018. (https://data.worldbank.org/). University of Papua New Guinea carried out giant clam culture and stocking of wild clams as a research activity.
- Other species attempted or planned: Pearl oyster – for a long time in Milne Bay province, but now no longer operating. Carp – several species

introduced. Barramundi at Madang – collapsed. Feed, marketing & management problems. Carpenters had a prawn farm in New Britain, but difficulty with disease (white spot), issues with exporting and seed. Seaweed has not been successful, except in Bougainville, and details are very sketchy. Local freshwater prawn *Macrobrachium spinipes* (formerly known as "eastern" strain of *M. rosenbergii*) successfully domesticated by SPC, NFA and UPNG research, but no commercial take-up of this opportunity. Continued expansion and redevelopment of the current species under cultivation and additional fin fish.

The Nago Island Mariculture and Research Facility (NIMRF) was established by NFA to conduct research into suitable commodities for the developing aquaculture sector of PNG. NIMRF has been assisted by the Australian Centre for International Agriculture Research (ACIAR) with the projects 'Mariculture Development in the New Ireland Province, Papua New Guinea' (FIS/2010/054) and 'Improving technical and institutional capacity to support development of mariculture based livelihoods and industry in New Ireland, Papua New Guinea' (FIS/2014/061) as well as smaller projects such as 'Pearl industry development in the western Pacific' (FIS/2009/057) and handicraft development using pearl shell. These ACIAR projects are largely focused on marine invertebrates (sea cucumbers and molluscs), with the exception of some ornamental clownfish and coral production. Since the departure of the ACIAR projects, NIMRF production has ceased (J. Kinch, per. com. March 2023).

NFA is making considerable efforts to upgrade its aquaculture database. It is expected that in early 2023 there will be a comprehensive baseline of aquaculture in PNG. As an example of the work leading up to the baseline, a survey was carried out in the East and West Sepik Provinces from December 2020 to March 2021. A total of 907 fish farms were surveyed: 649 in East Sepik and 258 in West Sepik. The results show that fish farming is widespread across all districts of both provinces, mostly as a family-oriented activity. In total, 87% of ponds in East Sepik and 45% of ponds in West Sepik are owned by families with primary intention to meet the protein needs of households. The main species farmed are the common carp and tilapia (Pandihau and Tiru 2021).

The Executive Manager of NFA's Aquaculture and Inland Fisheries Section (J. Wani, per. com. October 2022) kindly provided information on current national aquaculture production:

- Tilapia: 500 to 1,000 tonnes, with a farm gate value of K10 to 12.50 per kg.
- Carp: The annual production has fallen in recent years and is currently about 15 tonnes, with a farm gate value of K30 per kg.

- Trout: The annual production has risen in recent years to about 30 to 40 tonnes, with a farm gate value of K40 to 45 per kg.
- Prawns: There is currently no production.
- *Macrobrachium*: NFA has a hatchery, but there is currently no production.
- Barramundi: There is currently no production as the hatchery in Daru has ceased activity.
- Seaweed: When the sea cucumber moratorium was lifted a few years ago, seaweed production crashed. There were no exports in 2021, but production re-commenced in 2022. The farm gate price is 1K/kg.
- Crocodile: Slightly less than 10,000 skins were produced in 2021. The farm gate price is about K130–140 per skin.

Following from the above information (with some adjustments), the 2021 aquaculture production of PNG is estimated to be 850 t plus 10,000 pieces, with a farm gate value of K12,000,000.

### Summary of harvests

From the above sections, a crude approximation of the annual volumes and values[4] of the fishery and aquaculture harvest in 2021 can be made (Table 14-4).

Table 14-4: Annual fisheries and aquaculture harvest in PNG in 2021

| Harvest sector | Volume (t and pcs, where indicated) | Value (K) |
|---|---|---|
| Coastal commercial | 6,000 | 66,000,000 |
| Coastal subsistence | 40,000 | 280,000,000 |
| Offshore locally based | 170,755 | 719,000,000 |
| Offshore foreign-based | 161,133 | 732,000,000 |
| Freshwater | 23,000 | 129,000,000 |
| Aquaculture | 850 t and 10,000 pcs | 12,000,000 |
| **Total** | **401,738 t and 10,000 pcs** | **1,938,000,000** |

The extremely weak factual basis for the estimates of coastal commercial, coastal subsistence and freshwater catches is acknowledged.

[4] The values in the table are dockside or farm gate prices, except in the case of offshore foreign-based fishing where the value in local waters (overseas market prices less imputed transshipment costs) is given.

Figures 14-1 and 14-2 show the volumes and values of PNG fisheries and aquaculture production in 2021. Aquaculture is not shown in the volumes figure due to the use of mixed units (pieces and tonnes).

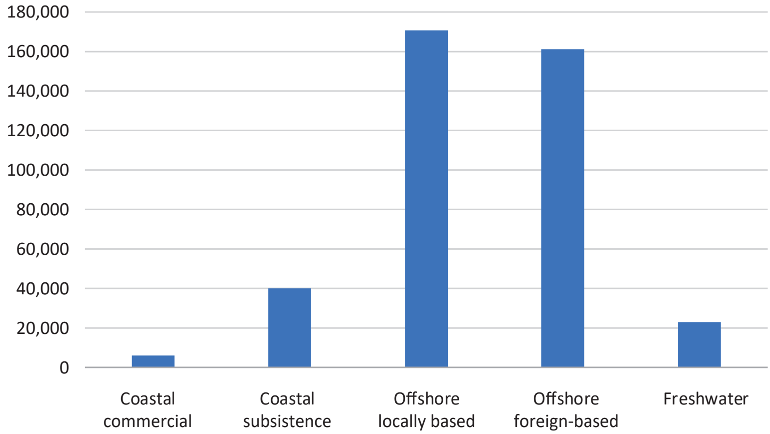



**Figure 14-1:** PNG fisheries and aquaculture production in 2021 by volume (t)

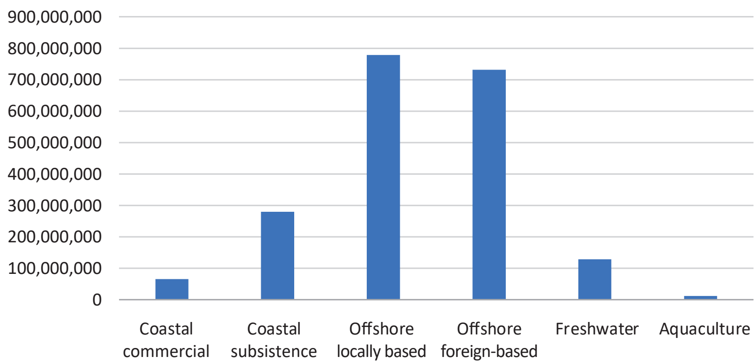



**Figure 14-2:** PNG fisheries and aquaculture production in 2021 by value (K)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish studies") have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for PNG from those four studies are provided in Table 14-5.[5]

Table 14-5: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (K) |
|---|---|---|---|
| Coastal commercial | 1999 | 5,500 | 55,000,000 |
| | 2007 | 5,700 | 80,000,000 |
| | 2014 | 6,500 | 130,000,000 |
| | 2021 | 6,000 | 66,000,000 |
| Coastal subsistence | 1999 | 26,000 | 52,000,000 |
| | 2007 | 30,000 | 105,000,000 |
| | 2014 | 35,000 | 171,500,000 |
| | 2021 | 40,000 | 280,000,000 |
| Offshore locally based | 1999 | 50,500 | 114,000,000 |
| | 2007 | 256,397 | 1,024,089,635 |
| | 2014 | 216,896 | 803,688,032 |
| | 2021 | 170,755 | 719,000,000 |
| Offshore foreign-based | 1999 | 85,000 | 193,000,000 |
| | 2007 | 327,471 | 1,143,631,355 |
| | 2014 | 217,871 | 799,393,686 |
| | 2021 | 161,133 | 732,000,000 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 17,500 | 49,000,000 |
| | 2014 | 20,000 | 98,000,000 |
| | 2021 | 23,000 | 129,000,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 200 | 2,000,000 |
| | 2014 | 145 t and 160,000 pcs | 3,156,700 |
| | 2021 | 850 t and 10,000 pcs | 12,000,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

5 The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

The apparent changes in production over the period covered by the studies represents a real change in production in some cases, but this can also represent a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for coastal subsistence and freshwater increase slightly between the years. This is because there are no new data for those fisheries, but anecdotal information suggests some increase (mostly due to population growth). In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

The effects of Covid are most pronounced in the coastal commercial fisheries, with a drop in volume of 8% between 2014 and 2021. A re-examination of the value of the 2014 coastal commercial catch has led to the conclusion that the assumed price to fishers in 2014 (K20/kg) was probably too high – and therefore the 2014/2016 comparison is distorted.

## 14.2 Contribution of fishing to GDP

### Current official contribution

The official contribution of fishing to PNG's GDP is given in NSO (2021b). That information, supplemented by unpublished data from NSO, is used to construct Table 14-6.

**Table 14-6:** Fishing contribution to PNG's GDP

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|
| Gross output fishing | 846 | 1042 | 1,194 | 1,795 | 2,103 | 2,287 | 2,327 | n/a |
| Value added fishing | 540 | 625 | 717 | 944 | 1,072 | 1,157 | 1,196 | 1,264 |
| Formal fishing | 93 | 140 | 199 | 389 | 468 | 507 | 500 | 511 |
| Informal fishing | 447 | 485 | 518 | 555 | 604 | 651 | 696 | 753 |
| PNG GDP | 47,721 | 57,131 | 60,139 | 65,038 | 72,522 | 79,405 | 83,845 | 82,500 |
| Value added fishing as % of PNG GDP | 1.1% | 1.1% | 1.2% | 1.5% | 1.5% | 1.5% | 1.4% | 1.5% |

Current prices; Units = Kina millions

It the above table, formal fishing is defined as fishing by goods and services tax (GST)-paying businesses, while informal fishing includes fishing for informal markets and fishing for subsistence (V. Nouairi, per. com. October 2022).

## Method used to calculate the official fishing contribution to GDP

NSO indicates that the general method used in most economic sectors to calculate GDP contribution is to take the gross output (GO) of production and reduce that value by intermediate consumption (IC) to determine the value added (VA) (i.e. GO–IC=VA). The fishing sector is divided into two components.

- To calculate the value added of "formal fishing", the results of business surveys are used and extrapolated for future years on the basis of export data.
- For "informal fishing", various sector studies provide the basic information along with the results of the recent HIES.

Limited comment can be made on the above methodology. Fishing carried out by businesses that are too small to be covered by business surveys mentioned above could have been omitted in the coverage of "formal fishing".

## Alternative estimate of fishing contribution to GDP

Table 14-7 (below) represents an alternative to the official method of estimating fishing contribution to GDP in PNG. It is a simplistic production approach that takes the values of six types of fishing/aquaculture activities for which production values were determined in Section 14.1 above (summarised in Table 14-4) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 14-7 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

**Table 14-7:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (K, from Table 14-4) | VAR | Value added (K) |
|---|---|---|---|
| Coastal commercial | 66,000,000 | 0.65 | 42,900,000 |
| Coastal subsistence | 280,000,000 | 0.90 | 252,000,000 |
| Offshore locally based | 719,000,000 | 0.50 | 359,500,000 |
| Freshwater | 129,000,000 | 0.95 | 122,550,000 |
| Aquaculture | 12,000,000 | 0.70 | 8,400,000 |
| **Total (K)** | **1,206,000,000** | -- | **785,350,000** |

The latest year for which the official PNG GDP is available is 2020. The Pacific Community (SPC) Statistics for Development Division has an unofficial projection of the GDP for the year 2021 of K93,314,000,000. The K785,350,000 fishing contribution in the alternative estimate equates to 0.84% of the 2021 GDP.

The official fishing contribution (for 2020) is 61% more than the alternative contribution (for 2021). In terms of GDP percentage, the official fishing contribution is 1.5% of the GDP in 2020, while the alternative fishing contribution is 0.84% of the GDP in 2021.

Why is the official fishing contribution so much more? Obviously, comparing two different years could be a source of difference, but that is a very large difference for being just one year apart. Covid in 2021 could also be a source of difference, but it was at least a factor in 2020. In addition, because the percentage of GDP between the two estimates is also large, it is unlikely to be responsible for much of the difference. If it is assumed that (1) the formal sub-sector of the official estimate corresponds to the offshore locally based of the alternative estimate, and (2) the informal sub-sector of the official estimate corresponds to the coastal commercial/subsistence, freshwater and aquaculture of the alternative estimate, then it is possible to construct Table 14-8.

Table 14-8: Comparing the value added of the official and alternative estimates

| Fishing sector | Value added (thousands of K) | Official vs alternative |
|---|---|---|
| Formal (of official) | 511,000 | Official is 42% greater |
| Offshore locally based (of alternative) | 359,500 | |
| Informal (of official) | 753,000 | Official is 55% greater |
| Coastal commercial/subsistence, freshwater, aquaculture (of alternative) | 487,000 | |

The following observations can be made:

- The official fishing contribution is 61% larger than that of the alternative – and both the formal and informal sub-sectors are 42% and 55% larger than that of the alternative, respectively.
- The value-added ratio for the entire fishing sector (for 2019) is 51% in the official estimate versus 62% in the alternative (for 2021), indicating that a higher VAR in the official estimate is not responsible for the difference.
- In a section above there is some question as to whether the PNG flag vessels and the PNG locally based foreign vessels are all truly locally based – and therefore part of the PNG economy for GDP purposes. Because

the formal sub-sector is so large in the official estimate, it is likely that those vessels are considered as part of the PNG economy in the official estimate.

- A greater gross output in the official estimate for both formal and informal sub-sectors probably accounts for much of the difference – but it is not possible to pinpoint which specific fisheries are responsible.

## 14.3 Exports of fishery production

The Papua New Guinea Fisheries Sector Executive Overview (NFA 2022b) gives the fishery exports of the country (Table 14-9).

**Table 14-9:** Fishery exports of PNG

| Product | Value in millions of Kina and millions of USD | | | | | |
|---|---|---|---|---|---|---|
| | 2018 | | 2019 | | 2020 | |
| | PGK | USD | PGK | USD | PGK | USD |
| Beche-de-mer | 93.55 | 28.22 | 3.38 | 1.02 | 32.2 | 9.4 |
| Crab | 6.28 | 1.90 | 10.99 | 3.32 | 6.6 | 1.9 |
| Fish (frozen, live, dried maw) | 1.44 | 0.43 | 2.38 | 0.72 | 2.3 | 0.7 |
| Lobster (frozen, live) | 8.67 | 2.62 | 14.51 | 4.46 | 12.3 | 3.6 |
| Shark (dried shark fin) | 2.27 | 0.68 | 2.87 | 0.86 | 2.0 | 0.6 |
| Shell (whole, dried) | 1.54 | 0.47 | 2.34 | 0.70 | 1.5 | 0.4 |
| Shrimps (frozen) | 12.16 | 3.69 | 11.78 | 3.55 | 12.1 | 3.6 |
| Stingray | 0.05 | 0.02 | 0.20 | 0.06 | 0.2 | 0.0 |
| Non-tuna sub-total | 125.96 | 38.03 | 48.45 | 14.69 | 69.2 | 20.2 |
| Tuna (canned) | 337.41 | 102.73 | 465.26 | 140.04 | 457.0 | 133.9 |
| Tuna (dried meal) | 74.86 | 22.36 | 17.62 | 5.30 | 24.4 | 7.1 |
| Tuna (fresh chilled) | 0.32 | 0.10 | 0.49 | 0.15 | 0.3 | 0.1 |
| Tuna (frozen flakes) | 7.43 | 2.25 | 16.84 | 5.07 | 6.5 | 1.9 |
| Tuna (frozen G & G) | 8.06 | 2.44 | 5.88 | 1.77 | 0.2 | 0.1 |
| Tuna (frozen loins) | 277.14 | 84.01 | 267.34 | 80.75 | 196.5 | 57.5 |
| Tuna (frozen whole round) | 732.93 | 223.31 | 671.34 | 202.07 | 759.9 | 223.4 |
| Tuna (fish oil) | 0.96 | 0.29 | 0.71 | 0.21 | 1.8 | 0.5 |
| Tuna sub-total | 1,439.11 | 437.49 | 1,445.48 | 435.36 | 1,446.6 | 424.5 |
| **Total fishery exports** | **1,565.08** | **475.52** | **1,493.95** | **450.07** | **1,515.7** | **444.7** |

Units = millions of K

The fishery exports in 2020 from Table 14-9 are shown in Figure 14-3.

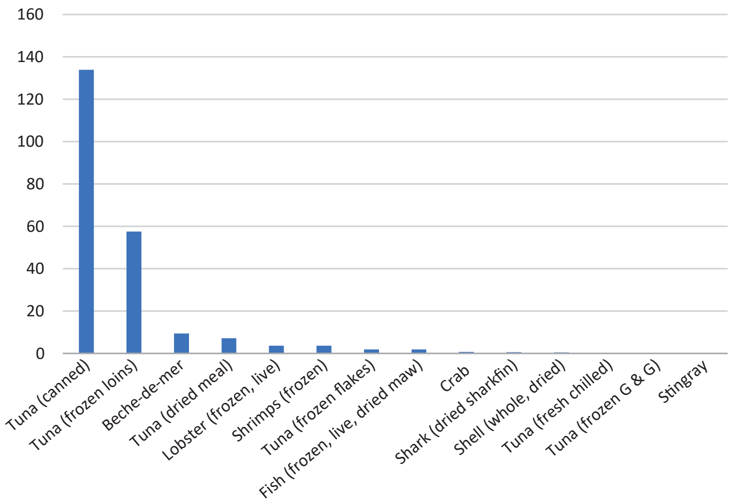



**Figure 14-3:** Fishery exports of PNG in 2020 (US$)

Some observations can be made on the exports.

- In 2020 all exports of PNG were valued at K35.1 billion (www.nso.gov.pg/statistics). In 2020 fishery exports of the country therefore equated to 1.27% of all exports.
- The fishery exports in 2020 do not appear to be greatly affected by Covid.
- During the years covered by the table, the non-tuna exports ranged from 3.4% to 8.8% of the value of tuna exports. It was 8.8% when there was no moratorium for the whole year on the beche-de-mer fishery (2018). During that year, beche-de-mer represented 74.3% of all non-tuna exports and 6.0% of all fishery exports.

## 14.4 Government revenue from fisheries

### Access fees for offshore fishing

The Papua New Guinea Fisheries Sector Executive Overview (NFA 2022b) provides information on fisheries revenue at the national level. It states that NFA has generated over K500 million on average per annum over the period 2020–2022 (about K525 for 2021), which is made up of access fees (94% of the fisheries revenue), license fees (3%) and others (3%). The access fees and license fees cited in the Sector Overview together fit into the definition of "access fees" of the present study.

The access fees and license fees for 2021 given in the Executive Overview are about K509 million. The central government's total revenue was about K16.2 billion in 2021 (Deloitte 2022), so these fees represent about 3.1% of the total government revenue in 2021. This is a considerable increase from the 1.7% noted for 2014 by Gillett (2016).

According to a knowledgeable PNG fisheries stakeholder, this increase in fisheries revenue reflects the rebate scheme approved by the National Executive Council in 2018, whereby all purse seine vessels pay minimum US$10,500 per day regardless of flag, and processors get a rebate only on fish actually processed. When this scheme began, about half the PNG flagged vessels fled to FSM, Nauru and Korea, PNG processing rose, PNG employment rose, PNG revenue rose and subsidised fish to the Philippines dropped (M. Brownjohn, per. com. March 2023).

### Other government revenue from fisheries

A limited quantity of information is available on national government revenue from the fisheries sector, other than access fees. As mentioned above, the revenue streams are access fees (94% of total), license fees (3%) and other (3%).

## 14.5 Fisheries-related employment

The major historical attempts to estimate employment in PNG's small-scale fisheries have been:

- A United Nations Development Programme (UNDP) report (1994) indicates that the coastal fishing population (those who are involved in some fishing activity at least once a week) is about 120,000. People involved in freshwater fishing (those who do some fishing at least once per week) number somewhat less than 125,000.
- Avalos (1995) comments on the gender aspects of participation in PNG's subsistence fisheries: "Women's role in fishing is much larger than is generally acknowledged. According to the Women's Sector Review, studies have shown that women catch at least 25% of the subsistence catch, or more if the crab catch is added. Furthermore, they are dominant in the processing stage of small-scale fisheries and contribute to the marketing of fish where the husband is involved in catching".
- Preston (2001) summarises much of what has been written on the subject in recent years: "Despite the widespread nature of subsistence fishing, in many instances it is sporadic, as most food production continues to be derived from agriculture. Nevertheless, a large number of people, estimated

at somewhere between 250,000 and 500,000, participate in the coastal subsistence fishery. The 1990 census estimated that 130,963 households, which is 23% of all rural households in the country, were engaged in catching fish (both marine and freshwater fishing). Of these households, 60% said they caught fish for home consumption only, while 40% caught fish both for food and for sale. A significant proportion of households were involved in fishing in all Provinces except those in the highlands. The highest proportion of fishing households occurred in Milne Bay (14.3% of households), East Sepik (11.3%) and Madang (10.0%)."

- Diffey (2005), using several sources, summarises the current state of knowledge: "In 1989 UNDP estimated that PNG had about 2,000 coastal village communities with a population of about 500,000 people. Of these, it was estimated that 120,000 were involved in regular fishing activity at least once a week and that there were between 2,000 and 4,000 part-time artisanal fishermen. These data are confirmed by the 1990 population census where NSO estimated that of 131,000 coastal rural households, 23% (30,000) were engaged in catching fish with 60% fishing purely for subsistence consumption and 40% for both food and for sale".

There have been few, if any, recent attempts to estimate the employment in small-scale fisheries in the country. The readily available documents on the most recent household income and expenditure survey (the 2009/10 HIES) do not cover fisheries, nor does the final report of PNG's 2011 census (NSO 2013).

By contrast, there is an abundance of information on employment in PNG's tuna industry. NFA (2022b) states:

> In 2021 the PNG national domestic fishing and processing industries supported around 12,652 people in direct employment and of this 96% are PNG nationals. Overall, the sector directly employed around 68% PNG females, 28% PNG males and 4% foreigners (both males and females) in 2021.

Similarly, the FFA Tuna Report Card (FFA 2022a) reports that the average annual employment in PNG's tuna industry over the three-year period 2018–2020 was 12,274.

Processing is responsible for most of the jobs in the tuna industry. A report by FFA (McCoy et al. 2015) provides some insight into processing employment (Box 14-6).

**Box 14-6:** Employment in tuna processing in PNG

The largest segment of employment of PNG nationals in the tuna sector is in tuna processing. Much of the impetus in fostering tuna industry development in PNG has come from recognition of the need for increased employment in a country with chronic unemployment, pervasive under-employment and dismal development indicators. Various estimates have stated the level of direct employment provided by tuna processing plants in the country during the period 2011–2012 as being from 5,800 to nearly 7,000 people. A 2012 report gave the total as around 6,700, 98 percent of whom were PNG nationals.

Taking stated production levels and employment for the three canneries, it is estimated that for daily production of up to around 150 tons (the average maximum processed so far by any one facility) an average of 20–24 employees are required for each tonne of tuna processed.

The labor-intensive nature of work within tuna processing facilities and difficult working conditions (i.e. standing for long periods each day, working in hot/damp conditions), results in canneries actively seeking young, fit workers with an emphasis on those between 18–35 years of age. The maximum age for production-line workers in PNG is said to be around 45.

Experience in large industrial tuna processing investments in PNG so far (RD, SSTC, Frabelle, Majestic) demonstrates that access to PNG's tuna resources is the main driver behind investment. Companies investing in the PNG tuna industry do so to achieve core business interests, and this includes investing to secure long-term access to resources. In the past all companies have limited production costs by reducing the percentage of catch processed in PNG and by keeping wages low. This keeps them competitive in the global industry, which in turn shapes the nature of tuna-based development in PNG. New requirements to process greater amounts of catch within PNG will test the viability of processors, some of which are already calling for additional government support to offset their higher costs of doing business in the country.

Source: McCoy et al. (2015)

Several studies (e.g. SPC 2013, McCoy et al. 2015) have shown the high percentage of women employed in tuna processing. An older study by SPC on gender in the tuna industry indicated that about 7,000 women worked in the PNG tuna industry, including onshore handling and loining or canning, and technical and administrative positions. The study concluded that the tuna industry employed 3.3% of all formally employed women in the country (Sullivan and Ram-Bidesi 2008).

## 14.6 Levels of fishery resource consumption

Preston (2001) summarises the older information on fish[6] consumption in PNG, as follows:

- Most documents and reports on nutrition in PNG focus on agriculture and animal husbandry and pay little attention to fish. Nevertheless, fish play an important role in food security, particularly in certain areas. On average, Papua New Guineans were estimated (Gibson 2000) to have consumed 10 kg of fresh, frozen or dried fish per capita, with a total value of K 60 million, in 1996. Urban dwellers had higher per capita consumption rates than rural dwellers (21 kg as opposed to 8 kg) but consumed less total value of fish (K26 million versus K34 million kina) due to their smaller numbers.
- In addition to fresh fish and seafood, tinned fish is an important source of dietary protein for many people. Gibson (2000) estimates that on average, Papua New Guineans consumed 3 kg per capita of tinned fish, valued at K63 million, in 1996. Again, urban dwellers had a higher per capita consumption than rural people (7 kg as against 2 kg) but consumed a lower total value.
- Most of the fish and seafood consumed in Papua New Guinea is domestically produced, including tinned fish. After accounting for seafood imports and exports, the apparent per capita seafood consumption[7] has been estimated by Preston (2000) to lie between 18.2 kg per year and 24.9 kg per year.
- Together, fresh and tinned fish provide a small but important source of high-quality protein in the Papua New Guinean diet. Gibson (2000) estimates that fresh fish provides about 1.1% of average calorific intake to the average Papua New Guinean (0.9% in rural areas and 2.3% in urban areas), while tinned fish provides an average of 0.6% (0.5% in rural areas, 1.4% for urban dwellers).

Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. For PNG, the per capita fish consumption (whole weight equivalent) was 28.1 kg per capita

[6] Preston (2001) uses the term "fish" to describe freshwater and marine finfish, shellfish and other aquatic food products.

[7] Apparent consumption is the composite of domestic production (subsistence and commercial) plus imports, less exports.

per year in urban areas (fresh fish made up 76% of this amount) and 10.2 kg per capita per year in rural areas (77% fresh fish).

The following summarise some general aspects of fish consumption in PNG:

- The 1996 HIES indicated that the consumption of fish (fresh, frozen and dried, including shellfish) was 10 kg/person/year. In urban areas it was 21 kg, and in rural areas it was 8 kg.
- NFA (2015) states that for the coastal and island areas of PNG, estimates of annual fish consumption per capita range from 4.8 kg to 24.9 kg.
- A report by the Asian Development bank (ADB 2014b) using FAO data shows that in PNG fish provides about 6.9% of the total protein supply for the country.

The scarcity of readily available recent information on fish consumption in PNG leads to reliance on the annual per capita consumption rates of the older studies.

In recent years, the domestic consumption of canned tuna is increasing in some Pacific Island countries. The FFA Tuna Report Card (FFA 2022a) states:

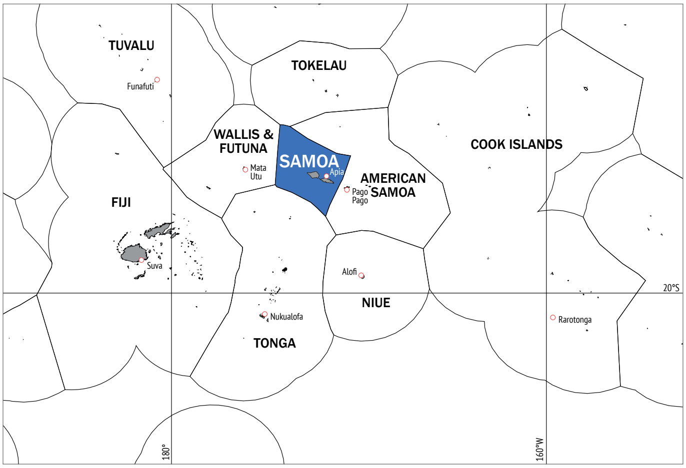
> Canned (mainly dark meat) tuna which is produced by local and overseas canneries and supplied to Pacific Island Countries. This study indicated the importance of canned tuna to local markets in some members, with annual consumption in the region's three largest countries ranging from 2,600 tonnes (Fiji), through to 3,000 tonnes (Solomon Islands) and 3,300 tonnes (PNG).

## 14.7 Exchange rates

The average yearly exchange rates (PNG Kina [K] to the US dollar) used in this book are as follows:

| 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|
| 2.98 | 3.25 | 3.25 | 3.25 | 3.41 | 3.51 | 3.51 | 3.52 |

# 15 Samoa




## 15.1 Volumes and values of fish harvests in Samoa

Categorising Samoan fishing activity requires special attention. The widespread use of "alia" catamaran fishing craft is unique to Samoa. While it is recognised that those vessels are not of industrial scale, due to the type of fishing gear used and the difficulty of separating the catch from those vessels from larger catamaran and mono-hull vessels, the catch from alia longliners in this book is considered to be a component of the "offshore locally based" catch.

### Coastal commercial catches in Samoa

Samoa has devoted more attention to estimating the production from its small-scale fisheries than any other Pacific Island country. In order for this study (and future studies) to benefit from those efforts, it is worthwhile recording the various surveys and associated results[1], with observations, as follows:

- The first assessment of Samoa's fisheries was completed by the Department of Statistics in 1978. About 48 villages on both Upolu and Savaii were surveyed for one week each quarter over the course of the year to determine total landings and seafood consumption. Offshore landings for the year were estimated at 424 tonnes (t), while inshore landings were estimated at 666 t.
- In 1991 the Fisheries Division and Food and Agriculture Organization (FAO) conducted the Inshore Resource Assessment Project. Originally

[1] The list consists of information summarised from Mulipola et al. (2007) and from Gillett (2016).

intended to be nationwide, the study focused on Upolu due to damage sustained on Savaii during the cyclones in 1990 and 1991. It was estimated that total inshore fisheries production in all of Samoa was 4,800 t per year.

- In 1997 there was a study of the subsistence and artisanal fisheries of Savaii. Additional analysis of data from the 1991 study was also included. The study estimated total inshore production in all of Samoa to be 4,200 t per year.
- A nationwide household fisheries survey was undertaken in October and November 2000 to collect subsistence fisheries data and to profile Samoan village fisheries. The survey covered 1092 households in 66 villages, 40 in Upolu and 26 in Savaii, i.e. a 20% coverage of villages and a 5% coverage of Samoa's households. The survey was based on respondents' recall of their fishing activities and seafood consumption patterns, rather than on direct measurements such as creel surveys or weighing food items to be consumed. The total coastal catch for the year 2000 was estimated at 7,169 t, with a value of ST$45 million. A total of 2,876 t was sold or given away, leaving 4,293 t for home consumption.
- A household income and expenditure survey (HIES) was carried out in 2002. Although the work was not fishery focused, the results of that work was further analysed to provide considerable insight into coastal fisheries production in the country. In summary, the survey estimated a coastal commercial catch of 4,076 t, worth ST$30 million, and a coastal subsistence catch of 4,437 t, worth ST$22.8 million.
- In 2003 the Fisheries Division completed two one-week creel surveys in 112 villages nationwide. The survey estimated 11,700 fishers in Samoa, with total landings of 12,270 t.
- The Samoa Fisheries Division carried out a fisheries socioeconomic survey in 2012. The survey was implemented in 100 villages in June and July 2012 (56 in Upolu and 44 in Savaii), which was about 30% of the total number of villages in Samoa. A total of 881 households were surveyed: 584 in Upolu and 297 in Savaii. The results of the survey showed that in 2012 the estimated total finfish catch was 9,066.32 t/year, with an estimated value of ST$89 million. The estimated catch of invertebrates was 7,804.42 t/year, with an estimated value of ST$86 million in income generated. The total annual coastal catch (commercial/subsistence and finfish/invertebrates) was 16,870 t (Tiitii et al. 2014).

The commendable fieldwork cited above has been examined and analysed by a number of simplistic desk-studies that attempted to estimate the volume and value of national fisheries production. These included:

- Gillett and Lightfoot (2001) adjusted the results of the 2000 study for various features (e.g. the value of subsistence catch based on farm gate prices) to estimate a coastal commercial production of 3,086 t (worth ST$19.9 million) and a coastal subsistence production of 4,293 t (worth ST$ 21.6 million).
- Gillett (2009a) modified the coastal commercial fishery production estimate of the 2002 HIES. The HIES volume was increased for population change during the period 2002–2007, and the value of this projected volume was priced according to the 2007 market and roadside fish prices. The 2007 production from Samoa's coastal commercial fisheries was estimated to be 4,129 t, worth ST$51,240,890. Including the estimate of the subsistence component, the total coastal catch was estimated to be 8,624 t in 2007.
- In Gillett (2016), with respect to Samoa, the historical studies cited above were examined, the remarkably large production result of the 2012 fisheries socioeconomic survey was scrutinised, and changes in recent years that would affect fisheries production (e.g. population change, impacts of cyclones/tsunami) were considered. The study concluded the total catch from Samoa's coastal fisheries in 2014 is likely to be 10,000 t, with the coastal commercial fisheries in the country providing 5,000 t, worth ST$42.5 million to fishers.

The total Samoa coastal fisheries production (commercial plus subsistence) from all 10 studies cited above are shown in Figure 15-1.

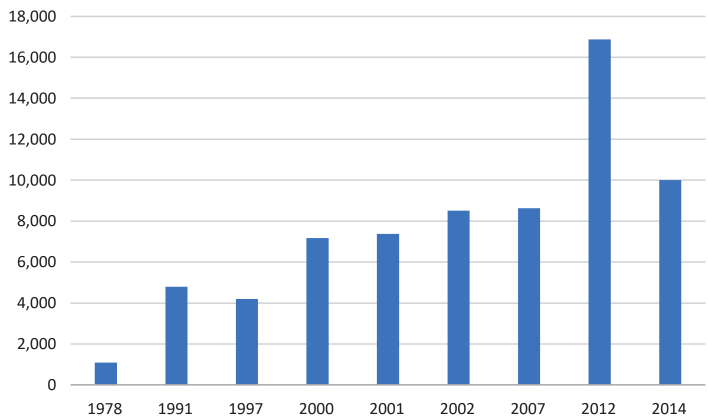



**Figure 15-1:** Historical estimations of Samoa coastal fisheries production (t). Source: studies cited above.

The volumes of total coastal catch estimated by the 2012 socioeconomic survey appears to be an outlier among the many surveys of Samoa's coastal catches.

In other words, the 16,870-t result of the 2012 survey is very different from the 6,000–10,000 t suggested by many of the previous surveys – indicating that the subject deserves more attention. Discussions with staff of the Samoa Bureau of Statistics indicate that they have examined the results of the 2012 survey. They do not use the results in their macroeconomic work as they feel the survey was overfocused on fishing communities and therefore not representative of all of Samoa. On the other hand, according to Fisheries Division staff, non-coastal villages were purposely included in the 2012 survey to eliminate a bias towards fishing communities – so they feel the surveyed villages are, on that basis, representative of all Samoa.

Of the studies cited above, many of those that occurred in the last 20 years divided coastal fisheries production into commercial and subsistence components and indicated that the two components were about equal in volume. There is some evidence that there is trend toward an increasing commercial proportion. The 2019 agriculture census (SBS 2021) indicates that between 2009 and 2019 there was a 23% increase in the number of households that sold all of their catch.

There have been no new field surveys in Samoa geared to the estimation of annual coastal fish catches since the fisheries socioeconomic survey in 2012. Although market surveys can give fish throughput on the markets that are surveyed and the associated trends, they are not geared to estimating national coastal fisheries production. There is a possibility that the 2018 HIES could be analysed for fish catch, but that has apparently not been attempted. In this situation, the best that can be done to make a new catch estimate for 2021 is to examine factors that could have affected fisheries production since the 2014 estimate in Gillett (2016) and use those factors to adjust the 2014 estimate.

Some of these factors *and some speculation on their effects on coastal fisheries production* are:

- The population of Samoa increased from 191,500 in 2014 to 199,853 in 2021 (SPC/SDD). This is a 4.3% increase in the period. *This could result in a slight increase in demand for fish.*
- There is a decline in participation in fishing. The 2019 agriculture census (SBS 2021) shows that a total of 2,759 households engaged in fishing activities, whereas in an earlier census, 5,752 households reported fishing activities in 2009. *This would tend to produce a downward trend in coastal fisheries production.*
- Samoa is prone to natural disasters. In February 2018 Cyclone Gita passed by Samoa and made landfall as a category 2 cyclone. *Some damage to fishing*

*boats and gear could have negatively affected fisheries production.* A drought was officially declared in Samoa for 2015. *The damaged crops could have led to a reduced food supply from farming and increased fishing effort.*

- World Bank data show that remittances increased in nominal terms from US$140 million in 2014 to US$155 million in 2019 and then accelerated to US$248 million in 2021. *This 77% increase in remittances could have led to increased ability to purchase food, including fish.*
- In 2019 Samoa started exporting reef fish, first to American Samoa and then expanding to New Zealand. *Depending on the quantities involved, this could have led to a reduced supply of fish in Samoa and increased prices.*
- Anchored fish aggregation devices (FADs) can substantially increase the landing of pelagic fish by coastal fishers. Around the year 2014 there were just one or two FADs sporadically in position, but in 2021, there were nine FADs in position: four in Upolu, four in Savaii and one in the middle between those islands (D. Itano, per. com. January 2023). *It is likely that skipjack and yellowfin landings at villages close to the FADs would have increased.*
- The most important factor affecting fisheries production is likely to have been Covid. According to the staff of the Fisheries Division, during the Covid period there was a decrease in fish market sellers, markets were closed on Saturdays and Sundays, and there was restricted access to urban areas. As explained by one fisheries officer, "there was an increase in subsistence fishing activity because there was nothing else to do". Church conferences (a major source of demand for fish) were largely not held during the Covid period. *In 2020 and 2021 Covid could have led to a reduced amount of commercial fish production and an increase in subsistence fish production.*

With respect to prices paid to fishers for coastal finfish and invertebrates, discussions were held with staff of the Fisheries Division and fish prices in various reports were examined. For the purposes of the present study, the price of ST$10.50 to fishers is used.

The above information is insufficient for adjusting the 2014 fish catch estimate and certainly inadequate for making a reasonably accurate new estimate.

An educated guess of the total catch from Samoa's coastal fisheries in 2021 is 11,000 t, with the coastal commercial fisheries in the country providing 5,500 t, worth ST$58 million to fishers.

### Coastal subsistence catches

Following from the above discussion, it is estimated that coastal subsistence fisheries in Samoa in 2021 caught 5,500 t of finfish and invertebrates. Taking 70% of the above commercial fish price (i.e. using the farm gate approach for valuing subsistence production), this was worth ST$40 million to the fishers.

### Locally based offshore catches

The report by Samoa to the Scientific Committee of the Western and Central Fisheries Commission (Fisheries Division 2022) states:

> In 2021, Samoa issued a total of 16 fishing licenses. In addition to Samoa's national fleet, there were 8 foreign flagged vessels authorized to fish in Samoa's EEZ which comprised of 4 Vanuatu flagged fishing vessels and 4 Cook Islands.....Samoa's fishing fleet comprises of both domestic fishing vessels and foreign fishing vessels that are authorized to fish in Samoa's EEZ. All catches from these vessels are landed and processed in Samoan ports.

Following from this quote, it will be assumed that all 16 vessels mentioned above are based in Samoa.

The report by Samoa to the Scientific Committee gives the catches by the 16 vessels (Table 15-1).

**Table 15-1:** Catches by the locally based tuna vessels

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Albacore tuna | 2,374 | 1,684 | 2,408 | 1,516 | 635 |
| Bigeye tuna | 150 | 62 | 145 | 166 | 39 |
| Yellowfin tuna | 644 | 401 | 486 | 648 | 264 |
| Skipjack tuna | 62 | 44 | 188 | 132 | 24 |
| Total tuna | 3,230 | 2,191 | 3,227 | 2,462 | 962 |
| Bycatch | 108 | 49 | 70 | 101 | 38.5 |
| Total | 3,338 | 2240 | 3,297 | 2,563 | 1,001 |

Source: Adapted from Fisheries Division (2022); Units = tonnes

Using prices from the Forum Fisheries Agency (FFA 2022b) and adjusting those destination market prices to be Samoa dock-side prices and accounting for the value of the bycatch equates to ST$10.3 million for the 1,001 t of tuna and bycatch in 2021.

### Foreign-based offshore catches

According to the Fisheries Division (2022), all catches in the Samoa exclusive economic zone (EEZ) were made by locally based vessels.

## Freshwater catches

The 2019 agriculture census reports that 60 households in Samoa engaged in at least some freshwater fishing in 2019, with 48 of those households on Upolu.

Staff of the Fisheries Division report that the main freshwater fishery species are tilapia (there are occasionally roadside sales near lakes), eels and freshwater shrimps. The total annual harvest is unknown but is likely to be about 10 t per year.

This 10 t can be valued with the approach used above for coastal subsistence catches, which results in an annual value for freshwater catches of about ST$73,500.

## Aquaculture harvests

A recent regional review of aquaculture (IAS 2022) commented on aquaculture in Samoa:

- Current species cultivated commercially: None. Hope to commercialise tilapia soon. Big problems with feed. Importation from Fiji is possible – there is already importation of chicken and pig food.
- Current species used for food security & small-scale community based production: Giant clam. Hatchery near the HQ. Distribute to 120 coastal communities. 2021 success with spawning. 10,000 juveniles produced in raceways now. Can produce as many as wanted. Put on the reef for restocking. Communities have to look after. Communities like a successful giant clam project. They can showcase them and also if they do ecotourism the tourists like them. Community sea grapes projects. Tilapia. Hatchery near the airport but has water quality problems. Tilapia for food security and some income. Grown in earth ponds, cement ponds and also natural water bodies. Trochus introduction was successful years ago and now some jewellery production. SPC been very helpful. Understands Samoa. Aquaculture production (metric tons) in Samoa was reported at 12.93 metric tons in 2018, according to the World Bank.
- Other species attempted or planned: Tilapia (*Oreochromis mossambicus*) introduced long ago. Trochus introduced long ago and now some jewellery production. Seaweed (*Kappaphycus*). Green mussel, macrobrachium, penaeid shrimp, native oyster, freshwater crayfish. More giant clams (*T. maxima* and *T. squamosa*), and more recently green snail. But the site selection of a hatchery is problematical. Interested in Sea cucumber. No capacity. SPC will assist and use the hatchery. Interested in sea grapes, this has reached pilot production. Interested in mangrove oysters, and mullet, which fetch high prices in Samoa.

The 2019 agriculture census (SBS 2021) has a chapter on aquaculture. The report of the census indicates that 98 households in Samoa were engaged in aquaculture, with 25 cultivating tilapia. It also reports the culture of marine fish, crustaceans (crabs, lobsters), molluscs (giant clams, trochus) and aquatic plants, but the report cautions that this "may be referring to the commodities associated with the village-owned fish reserves and their engagement is probably the household members' participation in communal activities maintaining the fish reserve."

According to the aquaculture staff of the Fisheries Division (U. Tiitii, per. com. October 2022), the main forms of aquaculture in Samoa in 2021 were:

- The culture of giant clams: The Fisheries Division spawns the clams and grows them to a size of 4 cm. They are distributed to villages for re-stocking and occasional use in village functions. The Fisheries Division produces about 10,000 such clams annually, and they are considered to be worth ST$1 apiece.
- The culture of tilapia: There are about 51 active farms (22 Upolu, 27 Savaii, 2 Manono) and the total production is about six to seven tonnes per year. The farm gate price is about ST$10 to $20.
- The culture of sea grape (*Caulerpa racemosa*) has been trialled in 10 villages.

It is estimated that in 2021 aquaculture in Samoa produced 6.5 t and 10,000 pieces, with a farm gate value of ST$107,500.

## Summary of harvests

From the above sections, an approximation of the annual volumes and values[2] of the fishery and aquaculture harvests in Samoa in 2021 can be made (Table 15-2).

**Table 15-2:** Fisheries and aquaculture harvest in Samoa in 2021

| Harvest sector | Volume (t or pcs) | Value (ST$) |
|---|---|---|
| Coastal commercial | 5,500 | 58,000,000 |
| Coastal subsistence | 5,500 | 40,000,000 |
| Offshore locally based | 1,001 | 10,300,000 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 10 | 73,500 |
| Aquaculture | 6.5 t and 10,000 pcs | 107,500 |
| **Total** | **12,018 t and 10,000 pcs** | **108,481,000** |

[2] The values in the table are dockside, farm gate or price to the fisher.

Figures 15-2 and 15-3 show the volumes and values of Samoa fisheries production in 2021.[3]

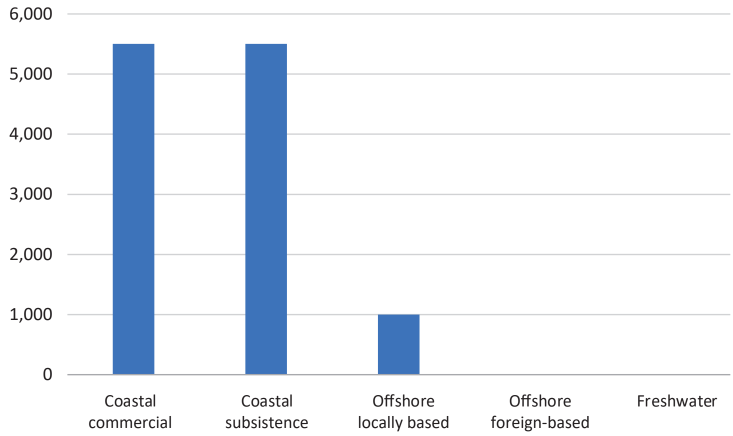



**Figure 15-2:** Samoa fisheries production in 2021 by volume (t)

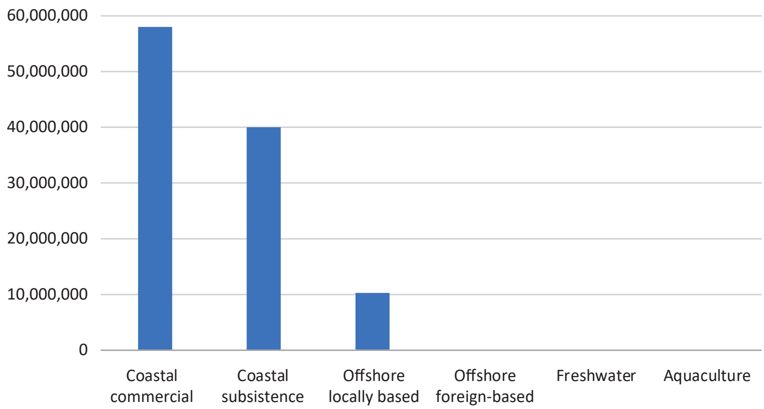



**Figure 15-3:** Samoa fisheries production in 2021 by value (ST$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett

[3] Aquaculture is not shown on the volume graph due to mixed units (tonnes and pieces).

(2016) on 2014, and the present study on 2021. The fishery production levels for Samoa from those three studies are provided in Table 15-3.[4]

**Table 15-3:** Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (ST$) |
|---|---|---|---|
| Coastal commercial | 1999 | 3,086 | 19,900,000 |
| | 2007 | 4,129 | 51,240,890 |
| | 2014 | 5,000 | 42,500,000 |
| | 2021 | 5,500 | 58,000,000 |
| Coastal subsistence | 1999 | 4,293 | 21,594,000 |
| | 2007 | 4,495 | 39,048,065 |
| | 2014 | 5,000 | 29,750,000 |
| | 2021 | 5,500 | 40,000,000 |
| Offshore locally based | 1999 | 5,156 | 29,748,440 |
| | 2007 | 3,755 | 21,910,631 |
| | 2014 | 1,254 | 11,152,478 |
| | 2021 | 1,001 | 10,300,000 |
| Offshore foreign-based | 1999 | 100 | 300,000 |
| | 2007 | 25 | 129,166 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 10 | 87,000 |
| | 2014 | 10 | 54,259 |
| | 2021 | 10 | 73,500 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 12 | 66,000 |
| | 2014 | 10 | 87,000 |
| | 2021 | 6.5 t and 10,000 pcs | 107,500 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

[4] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for most coastal commercial and coastal subsistence fisheries increase gradually between the years. That increase largely reflects the perception held by fisheries stakeholders that production has increased. In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 15.2 Contribution of fishing to GDP

### Current official contribution

The contribution of fishing to GDP, as stated in the GDP June 2022 Quarterly Report (SBS 2022c), is given in Table 15-4.

**Table 15-4:** Official contribution of fishing to GDP (ST$ millions)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Fishing | 57.4 | 47.9 | 43.7 | 43.6 | 37.4 |
| Samoa GDP | 2,252.2 | 2,313.2 | 2,417.2 | 2,209.6 | 2,191.2 |
| Fishing as a % of GDP | 2.5% | 2.1% | 1.8% | 2.0% | 1.7% |

Source: SBS (2022c)

### Method used to calculate the official fishing contribution to GDP

The staff of the Samoa Bureau of Statistics (SBS) explained that in the past the production approach for estimating GDP has been used, but for 2022 the SBS will use the expenditure approach. For GDP purposes, the fishing sector is divided into market and non-market components:

- The market component is comprised of inshore catches that are sold, offshore fish purchased and consumed, and exports. The HIES, fish outlet surveys, and export statistics are used to estimate the gross output of this component.
- The non-market component is equivalent to the coastal subsistence of the present study. The gross output for the non-market component is calculated from the HIES and adjusted yearly.

The gross output of market fishing is multiplied by a value-added ratio of 0.85 to obtain the value added (equivalent to the contribution to GDP). For the non-market component, gross output is multiplied by a value-added ratio of 0.95.

## Alternative estimate of fishing contribution to GDP

Table 15-5 (below) represents an alternative to the official method of estimating fishing contribution to GDP in Samoa. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 15.1 above (summarised in Table 15-2) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 15-5 replace the official methodology, but rather that the results obtained serve as comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

**Table 15-5:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production ($ST, from Table 15-2) | VAR | Value added (ST$) |
|---|---|---|---|
| Coastal commercial | 58,000,000 | 0.80 | 46,400,000 |
| Coastal subsistence | 40,000,000 | 0.90 | 36,000,000 |
| Offshore Locally based [5] | 5,150,000 [6] | 0.39 | 2,008,500 |
| Freshwater | 73,500 | 0.90 | 66,150 |
| Aquaculture | 107,500 | 0.74 | 79,550 |
| **Total** | **103,331,000** | - | **84,554,200** |

The total value added from fishing in Table 15-5 is ST$84,554,200, which equates to 3.8% of Samoa's GDP.

This is much greater than the official estimate of ST$37,400,000. It is difficult to determine the source of the difference because the specific amounts of the value added for market and non-market fishing in the official estimate are not readily available.

[5] Hamilton (2007) is an economic study of local longlining in Samoa. It determined that the value-added ratios for alia tuna longlining in Samoa were 0.46, and for conventional tuna longlining they were 0.38; so, a VAR of 0.39 is used here.

[6] Not all the locally based offshore vessels could be considered as part of the Samoa economy. At least some of those vessels have their centre of economic activity outside Samoa (e.g. the Fijian longliners). Accordingly, in the present study a semi-arbitrary 50% of the value of the catch of the locally based offshore vessels will be assumed to be from vessels that are not part of the Samoan economy. Should this not be the case, the gross output of the vessels judged to be locally based should be adjusted.

## 15.3 Exports of fishery production

The Quarterly Merchandise Trade Report for December 2021 (SBS 2022b) gives Samoa's fish exports and total exports (Table 15-6). It is evident that in the years covered by the table, the fish exports of the country declined in both relative and absolute terms. This is likely to be due to the negative impacts of Covid. In the decade before 2019, the situation was very different. There were only six major export commodities, of which fish represents almost half of total exports, followed by nonu juice, beer, taro, coconut and virgin coconut oil (SDG Taskforce, 2020).

**Table 15-6:** Fish exports of Samoa

| | 2019 | 2020 p | 2021 p |
|---|---|---|---|
| Fish, crustaceans and molluscs | 46,415 | 32,774 | 12,523 |
| All Samoa exports | 130,098 | 99,339 | 73,709 |
| Fish, crustaceans and molluscs as % of all exports | 35.7% | 33.0% | 17.0% |

Units = ST$ thousands; p = provisional

The Fisheries Division also tracks the fish exports of the country. Unpublished data from the Fisheries Division on pelagic and non-pelagic fish exports was used to construct Table 15-7, below.

**Table 15-7:** Pelagic and non-pelagic fish exports of Samoa

| | Non-pelagic | | Pelagic | | Total | |
|---|---|---|---|---|---|---|
| | Volume | Value | Volume | Value | **Volume** | **Value** |
| 2017 | 355.494 | 1,607,532.00 | 3808.864 | 29,746,961.00 | **4099.948** | **31,354,493.00** |
| 2018 | 291.084 | 3,379,495.00 | 4119.629 | 43,481,369.00 | **4386.112** | **46,860,864.00** |
| 2019 | 266.483 | 2,192,422.00 | 5484.044 | 45,176,063.00 | **5650.02** | **47,368,485.00** |
| 2020 | 165.976 | 516,016.00 | 4224.899 | 29,856,554.00 | **4287.45** | **30,372,570.00** |
| 2021 | 62.551 | 217,240.00 | 2006.655 | 13,553,864.00 | **2006.655** | **13,771,104.00** |

Units = tonnes and ST$

The Customs Department, the Central Bank of Samoa and the Fisheries Division all record the fishery exports of Samoa. The information for each of the three agencies should be identical, but they are all slightly different. This is probably because of the difficulties associated with compiling summaries from a large number of export documents. In general, in Samoa and in other Pacific Island countries, the customs departments produce more accurate summaries of the volume of total fish exports, while the fisheries divisions/departments are better at producing summaries of the species exported. As an example of the latter, unpublished data from the Customs Department show that sardines and halibut (types of fish that are not fished in or exported from Samoa) were major exports of Samoa in 2021.

## 15.4 Government revenue from fisheries

### Access fees for offshore fishing

In 2021 there were two types of authorised offshore fishing in the Samoa EEZ:

- Purse seining by vessels covered by the U.S. Tuna Treaty. Despite little or no fishing by that fleet occurring in Samoan waters in 2021, the country nonetheless received a payment under the treaty's licensing arrangements. The amount of that payment is not readily available, but it can be estimated from payments made to neighbouring countries. It is assumed that about US$972,000 was received by Samoa in 2021.
- The report by Samoa to the Scientific Committee of the Western and Central Fisheries Commission (Fisheries Division 2022) states that in 2021 Samoa issued a total of 16 offshore fishing licenses. In addition to Samoa's national fleet, there were eight foreign flagged vessels authorised to fish in Samoa's EEZ. According to a knowledgeable source (U. Faasili Jr., per. com. October 2022), each foreign fishing license cost US$15,000 (ST$38,850), and each national licence cost ST$8,000 (US$3,089). Samoa therefore received US$144,712 (ST$55,873) for access by the 16 offshore vessels.

For the above offshore fishing, it is estimated that Samoa received about US$1.1 million (ST$2.9 million) in 2021. This aligns reasonably well with the US$1 million estimated in FFA's 2022 Tuna Fishery Report Card as the average for Samoa's "tuna fishery access and licence fees" over the period 2019–2021.

The total revenue of the Samoa government for the fiscal year ending 30 June 2021 was ST$773.5 million (IMF 2021b). Therefore, the ST$2.9 million in access fees is equivalent to 0.37% of the total revenue of the Samoa government for that year.

### Other government revenue from fisheries

Apart from access fees for offshore fishing access, the other major source of government revenue from fisheries is from licensing of domestic fishing vessels. The government also receives money from licensing fisheries processing establishments, export certificates, market table renting, the sale of ice and transshipment. The total amount of money collected is not readily available.

## 15.5 Fisheries-related employment

The Samoa Agriculture Census 2019 is quite relevant to fisheries employment in the country. The 440-page report of the census (SBS 2021) has a chapter dedicated to fisheries. Some of the results related to fisheries employment are:

- Of the 28,516 households in Samoa in 2019, 2,759 (9.7%) were engaged in fishing activities during the reference period of three months prior to interviews.
- The number of households reporting engaging in fishing has been declining significantly, with 10,884 households reporting fishing activities in 1989, 6,699 in 1999 and 5,752 in 2009. Overall, the number of households engaged in fishing activities decreased by 8,156 (75%) in the last 30 years.
- 98 households were engaged in aquaculture in 2019.
- 88% of the 2,759 households engaged in fishing activities in Samoa were managed and operated by a single operator.
- In the reference week of the census, 5% of the participants in fisheries activities were women.
- The age group 25–44 represented 47% of all those engaged in fishing.

By contrast (and unlike the censuses in other Pacific Island countries), the report of the Samoa Population and Housing Census 2021 (SBS 2022d) has little information on fisheries. There are only three mentions of "fish" and none of the tables have fisheries information.

The different roles that men and women have in fisheries in Samoa was the subject of a report by the Pacific Community (SPC 2019c). Box 15-1 summarises the results.

**Box 15-1:** The roles of men and women in Samoa fisheries

Consultations between Fisheries Division staff and community members during the SPC research on gender and aquaculture highlight that women and men continue to have quite distinct roles and responsibilities, both within the household and in the community. Social norms and values reinforce these roles and hold them in place. While some women act more independently than others, and in some cases take the lead in aquaculture activities, there is an ongoing expectation that they must not abandon their roles as homemakers, mothers and 'village women'. In aquaculture, women and men divide the work of tilapia fish farming. Men tend to do the heavier tasks of digging ponds and piping water, while women are more likely to be responsible for regular pond maintenance. Men and women feed and harvest the fish and women do most of the post-harvest processing. Women are also involved in other fisheries. Little recent information on community fisheries was found during the desk review for this research, but older studies by Pacific regional agencies and government staff indicate that women and children collect many species of shellfish, beche-de-mer, sea urchins, octopus, crabs and seaweed from the shore area at low tide. Women may also dive from canoes for urchins, beche-de-mer and seaweed. Women's fishing techniques tend to be more low-tech than men's and involve only basic tools and equipment. A study in 2001 found that women made up an estimated 18% of all village fishers and were responsible for approximately 10% of a community's fishing effort. Women were also found to be the main contributors to post-harvest processing of all village catches. Men have historically been more involved in artisanal and commercial fisheries activities, fishing from boats or diving with spears or spear guns. In addition, fisheries extension services have largely focused on supporting men to upgrade technologies and techniques to encourage commercial activities and stimulate economic growth. The distinct roles, methods and knowledge used by women and men in their fishing activities indicate that they will have separate – but possibly overlapping – sets of knowledge and skills, and that they observe the environment differently.

Source: SPC (2019)

The December 2021 Employment Statistics Report (SBS 2022a) indicates there were 51 men and 17 women employed in "fishing" at the end of 2021. This appears to be a considerable underestimate of the actual situation – and is likely to be just the number formally employed in some sub-sector of fishing.

As compared to the above Employment Statistics Report, employment in Samoa's tuna industry is much greater. Such employment is covered in the "Tuna Fishery Report Card 2022" (FFA 2022a), which states that over the period 2018–2020, an annual average of 313 people had tuna-related employment.

## 15.6 Levels of fishery resource consumption

Table 15-8 (below) summarises recent estimates of fish consumption in Samoa. It is evident that there is some inconsistency, or at least lack of clarity, in what is being measured (e.g. fresh fish only, fresh plus canned) and how it is measured (e.g. fish actually consumed or whole fish equivalent).

**Table 15-8:** Estimates of per capita fisheries consumption in Samoa, various years

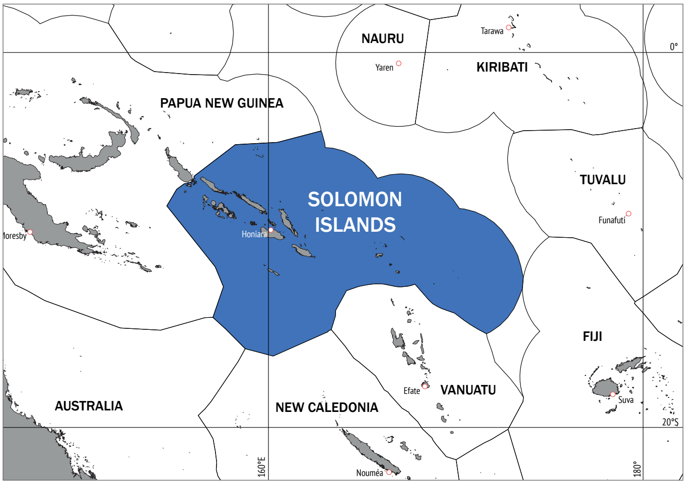
| Source | Year for estimate | Estimate | Comments |
|---|---|---|---|
| Troubat et al. (2020) | 2018 | This is a study of food security and food consumption in Samoa. It is stated that:<br>• About 164 grams of fish is consumed per day, of which half is in the form of canned fish (59.9 kg/person/year).<br>• Food insecure people consume a quantity of fish slightly higher than that consumed by food secure people. | Study is based on an analysis of the 2018 Household Income and Expenditure Survey. |
| Tiitii et al. (2014) | 2012 | • Finfish: Annual per capita consumption is 46.15 kg/year<br>• Invertebrates: Annual consumption is 54.74 kg/year<br>• Canned fish: Annual consumption is 28.61 kg/year | The report contains the note: "Invert consumption refers to whole fish equivalent. For example, for giant clams, includes weight of shells". |
| Bell et al. (2009b) | 2001–2006 | From HIES surveys conducted between 2001 and 2006. Per capita fish consumption (whole weight equivalent) was 45.6 kg per year for urban and 98.3 kg per year for rural. | |
| Mulipola et al. (2007) | 2006 | Fresh fish:<br>• Average frequency of consumption of finfish = 2.8 days/week, invertebrates = 0.8 days/ week<br>• Average per capita consumption per year = 59.4 kg, (163g/ day)<br>• Total consumption per year = 10,508 t (7,900 t for Upolu, 2,608 t for Savaii)<br>Tinned fish:<br>• Average frequency of consumption = 4.5 days/ week<br>• Average per capita consumption = 73 kg/year (206 g/person/day)<br>• 8,120 t of tinned fish consumed per year in Samoa | Based on asking people to estimate their usual catch.<br>The study appears to use food actually consumed. |
| Lambeth (2001) | 1990s | Women contribute around 23% of the total weight of seafood. Because women collect the majority of marine invertebrates in Samoa, it is estimated that they provide 20% of the per capita seafood consumption of 71 kg per year, consisting of 44 kg of fresh fish, 13 kg of invertebrates and seaweed and 14 kg of canned fish. | Gender-oriented survey applied to earlier consumption data. |

## 15.7 Exchange rates

The average yearly exchange rates (Samoan Tala [ST$] to the US dollar) used in this book are as follows:

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2.28 | 2.33 | 2.39 | 2.58 | 2.61 | 2.55 | 2.62 | 2.67 | 2.53 | 2.59 | 2.80 |

# 16 Solomon Islands




## 16.1 Volumes and values of fish harvests in Solomon Islands

### Coastal commercial catches in Solomon Islands

The general situation of coastal commercial fisheries in the Solomon Islands is described by Green et al. (2006) – which is still accurate today:

> The small-scale commercial fisheries are mainly located near the main urban area of Honiara, and to a much lesser extent, around the towns of Auki on Malaita Island and Gizo in the west. These fisheries are oriented to providing primarily finfish to wage-earning residents. The other common form of small-scale commercial fishing is that for non-perishable fishery products for export. The most important of these items are trochus shells, beche-de-mer, and shark fins. These commodities are an important source of cash for Solomon Islanders, especially in the isolated villages since the demise of the copra industry.

A fisheries specialist (S. Lindsay, per. com. January 2016) adds some information:

> Honiara is the nation's main market, and therefore receives fish, however it is not the main fishing area, due to overfishing in the direct area and neighbouring islands and improved shipping from other areas. The Auki area is starting to develop into a main market area, due to major population increases, but it is not nearly as big a market as Honiara.

The following summarise the main historical attempts to estimate coastal fisheries production in Solomon Islands:

- Dalzell et al. (1996), using information from three sources from the early 1990s, estimated annual volumes and values of coastal commercial production as 1,150 tonnes (t), worth US$4,343,811, and coastal subsistence production as 10,000 t, worth US$8,405,660.
- Gillett and Lightfoot (2001) considered six sources of information on coastal commercial fisheries production in the period 1988–2000 and ventured an annual estimate of 3,200 t (worth SI$9,200,000). They estimated coastal subsistence production of 13,000 t.
- Gillett (2009a) considered the above estimates and divided coastal commercial fishing in the country into three components: (1) local sales for domestic consumption: about 1,500 t, worth about SI$12 million annually to fishers for the years 2005–2007; (2) baitfish: about 800 t, worth SI$0.8 million annually to the recipient communities for 2005–2007; and (3) exports: about 950 t, worth SI$12.5 million annually to fishers for the years 2005–2007. Total production and value for coastal commercial fishing for 2007 was estimated to be 3,250 t, worth SI$25,300,000.
- In an International Union for Conservation of Nature (IUCN) study (Arena et al. 2015), commercial inshore fisheries were valued at SI$70 million/year (approx. US$9.32 million/year). These results are based on the 2009 Census (SINSO 2009) and data from the Pacific Regional Oceanic and Coastal Fisheries (PROCFish) project of the Pacific Community (SPC). The commercial production estimated by this study is almost three times higher than that of Gillett (2009a). The study uses PROCFish data at four villages in Solomon Islands (Pinca et al. 2009c) to produce estimates of annual household catches by frequency of fishing (e.g. a household that fishes once a week catches, in total, 363 kg/year).
- Gillett (2016) considered the Arena et al. study (2015) and recent events that would affect the production of coastal fisheries, including changes in the amounts of exports from coastal fisheries, the growth of the "salt fish

trade"[1], increased overexploitation of fishery resources targeted by coastal commercial fishing, changes in the throughput of major fish markets, and the increasing population of the major urban centres. The study concluded that the results of the Arena et al. study (2015) relied too heavily on the four villages of the PROCFish study being representative of the entire country, a feature that inflated the estimate of coastal fisheries production in the country. For coastal commercial fisheries the Gillett study (2016) settled on about 6,400 t, worth SI$98 million, but acknowledged that there is insufficient information available to make a definitive statement on the likely level of catches.

For the present study, it is assumed that Gillett (2016), despite its shortcomings, is the most accurate estimate of coastal fisheries production – and the best that can be done for this study is to adjust the amounts to take account of changes in conditions in the period 2014–2021.

The most remarkable change is due to Covid. The general impression from the literature (e.g. Eriksson et al. [2020], Wale [2020]) and from discussions with Ministry of Fisheries and Marine Resources (MFMR) staff is that during the pandemic many residents of urban areas and students returned to their villages and there was an increase in participation by those returnees in simple fishing activities that did not require specialised knowledge or gear. The marketing of fish from other islands to Honiara was curtailed. Overall, during the Covid period it is likely that there was a substantial decrease in coastal commercial fishing and a lesser increase in coastal subsistence fishing.

The decrease in coastal commercial activity is reflected in exports. Gillett (2016) reports that about 1,435 t of coastal fishery products (worth SI$8 million to the fishers) were exported during 2014. Unpublished data from MFMR shows that only SI$2.8 million[2] of coastal fishery products were exported during 2021.

Increased urbanization in the period 2014–2021 would lead to increased demand for the production from coastal commercial fishing – but it is likely that this effect would be overwhelmed by the various impacts of Covid, including the reduced ability of the public to pay, fish market closures and difficulties in the transport of fish.

[1] This consists of selling, from tuna transshipment operations in Honiara, non-target bycatch, and damaged target tuna that are otherwise unmarketable. McCoy (2013) indicates that this trade puts about 440 to 500 t of fish annually on the Honiara market. This is likely to reduce, to some extent, demand in Honiara for coastal fish.

[2] This is presumably the FOB value. The price paid to fishers would be about half of that.

Other relevant information is:

- MFMR staff indicate that the average price in 2021 to fishers for the production of coastal commercial fisheries was SI$16/kg (B. Buga, per. com. October 2022).
- Harvesting of sea cucumber has a major impact on the value of coastal commercial fishing. During 2014 there was a ban on sea cucumber, while in 2021 the season was opened for the last four months.

The available information is insufficient for making even a crude estimate of the production of coastal fisheries in the country in 2021. For the purposes of the present study, it is deemed that the volume is 5,000 t, and the value is SI$80,000,000.

### Coastal subsistence catches

Many of the historical estimates of coastal subsistence fisheries production in Solomon Islands can be traced to one of two statements:

- Cook (1988) states: "Virtually no data have been collected on the artisanal and subsistence fisheries in the past, apart from the irregular reports of fish purchases and sales through the fisheries centers and substations. Current estimates of the artisanal and subsistence production are based on a 1983 estimate of 40.0 kg per capita consumption, giving a national production of 6,000 to 12,000 tonnes."
- Skewes (1990) states: "A survey conducted by the National Statistics Office in 1983 indicated an average per capita fish consumption of 25.7 kg/year. A subsequent survey in 1988 (unpublished) indicated total seafood consumption of 34.4 kg/person/year, comprising 22.4 kg of marine fish and 12kg of shellfish. Shellfish consumption appeared to be concentrated in the Western Provinces. Using these figures, the national total subsistence catch is probably of the order of 10,000 tonnes/year in 1990."

More recent estimates of the subsistence catch are:

- The World Bank (2000) estimates that subsistence fishery production in Solomon Islands consists of 8,817 t of finfish and 4,747 t of shellfish, for a total production of 13,564 t.
- Gillett and Lightfoot (2001) venture an estimate of 13,000 t, worth SI$39 million.
- Gillett (2009a) estimates a catch of 15,000 t, worth SI$84 million, for 2007.
- An IUCN study (Arena et al. 2015) gives a total subsistence catch for the country as 33,561 t.

- Gillett (2016) expanded the Gillett (2009a) catch estimate by population growth in the period 2007–2014 to arrive at 17,865 t. Mindful of the larger IUCN estimate, it settled on a 2014 coastal subsistence catch of 20,000 t, worth SI$252 million to the fishers – but noted that this is necessarily based on informed guesswork.

Some additional information relevant for estimating the coastal subsistence catch in 2021 is:

- In the section above it is stated that during the Covid period it is likely that there was a substantial decrease in coastal commercial and a lesser increase in coastal subsistence fishing.
- MFMR staff feel that in normal times, about 80% of the coastal fisheries catch is for subsistence.

Following from the above, an educated guess of the production from coastal subsistence in 2021 is about 25,000 t, worth SI$325 million to the fishers.

## Locally based offshore catches

In the Solomon Islands annual report to the Scientific Committee of the Western and Central Pacific Fisheries Commission (MFMR 2022), the composition of the "domestic fleet" is given: eight purse seiners, four pole-and-line vessels and 33 longliners. The report refers to the latter vessels as "foreign locally based (chartered) longline vessels". The total retained fish catch of the domestic fleet is given in Table 16-1.

**Table 16-1:** Solomon Islands domestic fleet catch (t)

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Purse seine | 50,635 | 71,307 | 32,915 | 41,176 |
| Pole-and-line | 1,080 | 1,121 | 1,203 | 1,213 |
| Longline | 8,640 | 10,553 | 6,108 | 6,187 |
| **Total** | **62,373** | **85,000** | **42,246** | **50,597** |

Source: MFMR (2022)

The volume of the longline catch dropped substantially between 2019 and 2020, presumably due to the impacts of Covid. MFMR staff indicate that wharf operations of the vessels were negatively affected, and the lack of observers on the pole-and-line and longline vessels could have resulted in less reliable data. The Central Bank of Solomon Islands (CBSI) reports "fishing activities in the fishing sector weakened during the first quarter of 2022 with total fish catch falling by 22% to 5,909 tons from 7,579 tons in the previous quarter. The series of lockdowns and curfews amidst the COVID-19 community outbreak coupled with unfavourable weather conditions contributed to this outcome" (CBSI 2022).

Using prices from the Forum Fisheries Agency (FFA 2022b) and adjusting those destination market prices to be Solomons in-zone prices and accounting for the value of the bycatch gives the 2021 value of the domestic fleet catch (Table 16-2).

**Table 16-2:** In-zone value of the domestic fleet catch

| | US$ | SI$ |
|---|---|---|
| Purse seine | 62,089,290 | 499,818,788 |
| Pole-and-line | 1,907,442 | 15,354,912 |
| Longline | 15,152,460 | 121,977,303 |
| **Total** | **79,149,192** | **637,151,003** |

Source: MFMR (2022), FFA (2022b)

## Foreign-based offshore catches

The Solomon Islands annual report to the Scientific Committee of the Western and Central Pacific Fisheries Commission (MFMR 2022) states that 112 foreign purse seiners and 22 foreign longliners operated in the exclusive economic zone (EEZ) of the Solomon Islands in 2021. Those vessels made a catch of 62,234 t. Using pricing information in FFA (2022b) and adjusting for in-zone prices (FFA prices are at destination markets) and (for longline) for bycatch, the value of the 2021 catch is estimated to be SI$631,789,004 (Table 16-3).

**Table 16-3:** Volume and value of the catches of foreign-based vessels

| | Volume (t) | In-zone value (US$) | In-zone value (SI$) |
|---|---|---|---|
| Purse seine | 60,320 | 70,396,456 | 566,691,471 |
| Longline | 1,914 | 8,086,650 | 65,097,533 |
| **Total** | **62,234** | **78,483,106** | **631,789,004** |

Source: MFMR (2022), FFA (2022b)

## Freshwater catches

The many large islands in the country result in a relatively substantial inland population having no direct access to marine food resources, and for this reason, Solomon Islands has a significant subsistence freshwater fishery. Although some of the freshwater catch may be sold, the vast majority is for subsistence purposes. The main fishing and landing areas are small streams near villages and the banks of larger rivers, mainly on the larger islands. The smaller islands and atolls generally have no sizeable freshwater bodies and consequently, no freshwater fishing activity. Information is scarce on the resources that support the inland fisheries, and no comprehensive survey has been carried out. Anecdotal information and survey reports that focus on single islands suggest that flagtails, gobies, eels and freshwater shrimps are important native species. Mozambique tilapia presently inhabits many rivers, streams and swamps in Solomon Islands. Many people have become accustomed to eating it and enjoy its taste. On Rennell Island, communities have come to depend heavily on the tilapia in Lake Tegano as their main source of dietary protein (Coates 1996; MFMR 2010; Govan et al. 2013).

Limited by the information scarcity described above, freshwater fishery production in Solomon Islands in 2014 was deemed by Gillett (2016) to be 2,300 t, with a farm gate value of SI$29 million. According to MFMR staff, there have been no surveys of freshwater fish in at least 10 years. Catch levels probably increased during the Covid period along with that of coastal subsistence fishing. For the purposes of the present study, the 2021 freshwater catch is assumed to be 2,500 t, with a value to the fishers of SI$34 million.

### Aquaculture harvests

A recent regional review of aquaculture (IAS 2022) commented on aquaculture in the Solomon Islands:

- Current species cultivated commercially: *Kappaphycus* seaweed. Local farmers, private buyer. Single monopoly buyer, but recently production has declined due to low prices and competition from other income earning opportunities. Wagina in Choisul is currently the most active area in seaweed. Maximum production (2014) was 1500 tonnes/year, but now only ~345T/year. World bank data shows 5,520 tonnes of aquaculture production in 2018.
- Current species used for food security & small-scale community based production: Tilapia (*Oreochromis mossambicus*) on Guadalcanal and Malaita Islands, expanding to other islands on small-scale. Sea cucumber for communities. OFCF research has targeted the "peanut-fish" (*Stichopus horrens*), and many juveniles have been distributed (2020).
- Other species attempted or planned: Tilapia was introduced long ago, in early 1960s. Freshwater species of interest have included freshwater crayfish but there are serious problems which make it unfeasible. Penaeid prawn on Guadalcanal which stopped after the tensions in 2000. Aquarium fish and corals now stopped. Giant clams (*T. maxima and T. squamosa*), and more recently green snail. But the site selection of a hatchery is problematical. Introduction of GIFT Nile tilapia to improve the genetic stock.

According to the Permanent Secretary of MFMR (C. Ramofafia, per. com. October 2022), aquaculture production in 2021 consisted of tilapia (mainly on Malaita and Guadalcanal) and seaweed, with a small amount of coral culture. Aquaculture staff of the Ministry provide further details:

- The 300 active farms in 2021 produce on average about 500 kg per farm or a total of about 150 tonnes total. The farm gate price for tilapia is about SI$2 for 50 gram fish, SI$5 for 80–100 gram fish and SI$10 for 300 gram fish.
- In 2020 about 2,500 tonnes of seaweed was produced, and in 2021 the production was about 3,000 tonnes. The price in 2021 was SI$5/kg.
- Only a tiny amount of coral was cultured in 2021.
- The sea cucumber culture is still at an experimental stage.

Table 16-4 summarises aquaculture production in the Solomon Islands in 2021:

**Table 16-4:** Aquaculture production in 2021

| | Volume (t) | Farm gate value (SI$) |
|---|---|---|
| Tilapia | 150 | 750,000 |
| Seaweed | 3,000 | 15,000,000 |
| **Total** | **3,150** | **15,750,000** |

## Summary of harvests

A crude approximation of the annual volumes and values of fishery and aquaculture production in 2021 can be advanced (Table 16-5).

**Table 16-5:** Annual fisheries and aquaculture harvest in Solomon Islands in 2021

| Harvest sector | Volume (t) | Value (SI$) |
|---|---|---|
| Coastal commercial | 5,000 | 80,000,000 |
| Coastal subsistence | 25,000 | 325,000,000 |
| Offshore locally based | 50,597 | 637,151,003 |
| Offshore foreign-based | 62,234 | 631,789,004 |
| Freshwater | 2,500 | 34,000,000 |
| Aquaculture | 3,150 | 15,750,000 |
| **Total** | **148,481** | **1,723,690,007** |

The extremely weak factual basis for the estimates of coastal commercial, coastal subsistence and freshwater catches is acknowledged.

Figures 16-1 and 16-2 show the volumes and values of Solomon Islands fisheries production in 2021.

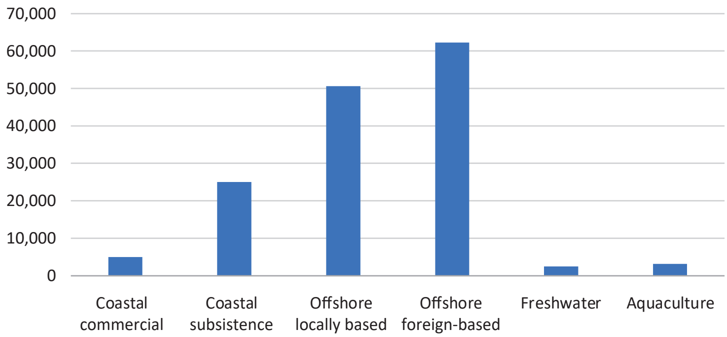



**Figure 16-1:** Solomon Islands fishery and aquaculture production in 2021 by volume (t)

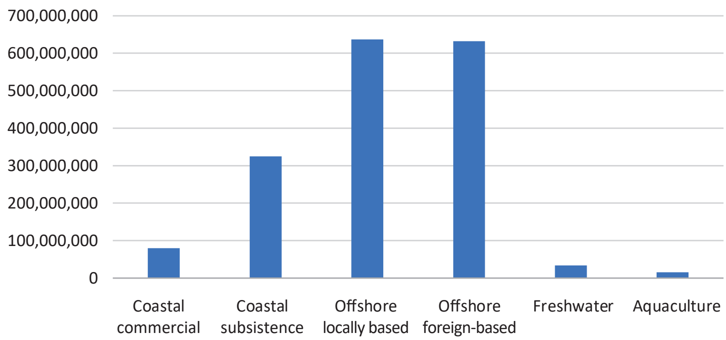



**Figure 16-2:** Solomon Islands fishery and aquaculture production in 2021 by value (SI$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for Solomon Islands from those four studies are provided in Table 16-6.[3]

[3] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 16-6: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (SI$) |
|---|---|---|---|
| Coastal commercial | 1999 | 3,200 | 9,200,000 |
| | 2007 | 3,250 | 25,300,000 |
| | 2014 | 6,468 | 98,032,500 |
| | 2021 | 5,000 | 80,000,000 |
| Coastal subsistence | 1999 | 13,000 | 39,000,000 |
| | 2007 | 15,000 | 84,000,000 |
| | 2014 | 20,000 | 252,000,000 |
| | 2021 | 25,000 | 325,000,000 |
| Offshore locally based | 1999 | 73,328 | 335,000,000 |
| | 2007 | 23,619 | 249,864,889 |
| | 2014 | 41,523 | 438,879,607 |
| | 2021 | 50,597 | 637,151,003 |
| Offshore foreign-based | 1999 | 948 | 4,000,000 |
| | 2007 | 98,023 | 1,174,648,841 |
| | 2014 | 36,573 | 604,512,524 |
| | 2021 | 62,234 | 631,789,004 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 2,000 | 11,200,000 |
| | 2014 | 2,300 | 29,000,000 |
| | 2021 | 2,500 | 34,000,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 165 t and 8,202 pcs | 311,000 |
| | 2014 | 1,530 t and 20,000 pcs | 5,900,000 |
| | 2021 | 3,150 | 15,750,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for coastal commercial, coastal subsistence and freshwater change between the years, but some of that change is due to the way in which the production was estimated. For example, the IUCN study considered new data and made new estimates of coastal fisheries production that are partially reflected in the estimates in the table above. In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 16.2 Contribution of fishing to GDP

### Current official contribution

The Statistics Office of the Ministry of Finance and Treasury calculates the official GDP of Solomon Islands. Estimates of fishing contribution to GDP for recent years appear in Table 16-7.

**Table 16-7:** Fishing contribution to GDP in the Solomon Islands

| | 2018 | 2019 | 2020 p |
|---|---|---|---|
| Fishing contribution | 771.8 | 850.1 | 765.4 |
| Total GDP | 12,847.1 | 13,234.0 | 12,617.0 |
| Fishing as a % of GDP | 6.01% | 6.42% | 6.07% |

Current prices; p = provisional; units – millions of Solomon Islands dollars. Source: SINSO (2022)

According to a CBSI official, that institution also calculates the GDP of Solomon Islands for internal purposes in order to have figures available early in the year for planning purposes. CBSI recognises that not all fishing sub-sectors are covered in its calculations (J. Rohi, per. com. September 2022). In a central bank publication (CBSI 2022), the fishing contribution to GDP (in constant prices) is forecast to increase by 5.8% between 2020 and 2021.

### Method used to calculate the official fishing contribution to GDP

In the methodology used by the Statistics Office, the fishing sector is made up of two components: the formal sector; and the informal sector, comprising monetary fishing (outboard motor fishing and gathering other marine products) and subsistence fishing.

According to staff of the Statistics Division (A. Kakate, per. com. October 2022), the contribution to GDP of each fishing sector is calculated by taking gross output minus intermediate consumption to give the value added, which is equivalent to the contribution of the sector to GDP. These calculations for 2020 are shown in Table 16-8.

The staff of the Statistics Office indicate that gross output and intermediate consumption for the formal sector are determined from replies to a questionnaire sent to the major fishing companies. The contribution of the various components of the informal sector are calculated using information from the most recent household income and expenditure survey (HIES 2012/13).

**Table 16-8:** Calculating the 2020 fishing sector contribution to GDP

| Formal sector | |
|---|---|
| Gross output | 654,498 |
| Intermediate consumption | 468,187 |
| Gross value added | 186,311 |
| **Informal sector** | |
| Gross output | 743,889 |
| Intermediate consumption | 164,770 |
| Gross value added | 579,120 |
| **Total formal plus informal sectors** | **765,431** |

Current prices; Units = thousands of Solomon Island dollars

In the table above the SI$765,431,000 total is precisely the fishing sector contribution to GDP given in Table 16-7 in the previous section.

## Alternative estimate of fishing contribution to GDP

Table 16-9 (below) represents an alternative to the official method of estimating fishing contribution to GDP in Solomon Islands. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 16.1 above (summarised in Table 16-5) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 16-9 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

Table 16-9: Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Value (SI$) (from Table 16-5) | VAR | Value added |
|---|---|---|---|
| Coastal commercial | 80,000,000 | 0.75 | 60,000,000 |
| Coastal subsistence | 325,000,000 | 0.90 | 292,500,000 |
| Offshore locally based | | | |
| Purse seine | 499,818,788 | 0.50 | 249,909,394 |
| Pole-and-line | 15,354,912 | 0.60 | 9,212,947 |
| Freshwater | 34,000,000 | 0.92 | 31,280,000 |
| Aquaculture | 15,750,000 | 0.73 | 11,497,500 |
| **Total** | **969,923,700** | | **654,399,841** |

As mentioned in a section above, according to MFMR (2022), the "domestic fleet" is composed of eight purse seiners, four pole-and-line vessels and 33 longliners. The report refers to the latter vessels as "foreign locally based (chartered) longline vessels". The table above does not include a GDP contribution from those vessels as their "centre of economic activity" (as used in the international System of National Accounts) does not appear to be in the Solomon Islands. Should the Solomon Islands Statistics Office or MFMR consider the activities of the "foreign locally based (chartered) longline vessels" as part of the Solomon Islands economy, the contribution from those vessels of SI$24,395,460 (SI$121,977,303 * a VAR of 0.2) should be added to the GDP contribution of the sector in the above table.

If the "formal sector" of the official approach equates to the "offshore locally based" of the alternative approach, then Table 16-10 can be constructed.

Table 16-10: Value added of the two approaches

| Sector | Official for 2020 (SI$) | Alternative for 2021 (SI$) |
|---|---|---|
| Total value added of fishing sector | 765 million | 654 million |
| Formal sector value added | 186 million | 259 million |
| Informal sector value added | 579 million | 395 million |

From the table, the following features are evident:

- Obviously, a comparison between two different years is responsible for some of the difference.
- In the official approach, the value added of the formal sector does not seem to include the value added of all eight purse seiners and four pole-and-line vessels.

- As the formal sector of the official approach is much less than that of the alternative approach, it is likely that the official approach does not consider the "foreign locally based (chartered) longline vessels" as part of the Solomon Islands economy.
- The only information available on the methodology of estimating the value added of the informal sector in the official approach is "calculated using information from the most recent household income and expenditure survey". It is therefore not possible to determine why the two informal sector estimates are so different.

## 16.3 Exports of fishery production

There are two systems for tracking the fishery exports of the Solomon Islands: data from the Customs Division and that of the MFMR. The Customs Division uses Harmonized System (HS) codes[4] for classifying export, with HS 03 being "fish and crustaceans, molluscs and other aquatic invertebrates". Customs data is used to construct Table 16-11.

**Table 16-11:** HS 03 Exports of the Solomon Islands

| | HS 03 exports | Total exports | HS 03 as % of total exports |
|---|---|---|---|
| 2015 | 300,983 | 3,138,150 | 9.59 |
| 2016 | 291,563 | 3,447,253 | 8.46 |
| 2017 | 400,195 | 3,933,357 | 10.17 |
| 2018 | 372,646 | 4,521,966 | 8.24 |
| 2019 | 316,109 | 3,764,931 | 8.40 |
| 2020 | 230,839 | 3,113,154 | 7.40 |
| 2021 | 368,390 | 2,980,765 | 12.36 |

Units: SI$ thousands Source: Courtesy of N. Lal, SPC/SDD

Table 16-11 is restricted to category HS 03 and therefore does not include HS 16, which consists of "preparation of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates". HS 16 includes canned fish and tuna loins which are an important export of the Solomon Islands. An alternative source of Customs Division fishery export information is in the quarterly reports of CBSI. They give "fish exports" which apparently include canned tuna and tuna loins. The CBSI fish export data is given in Table 16-12.

[4] The Harmonized System (HS) is a standardized numerical method of classifying traded products.

Table 16-12: Fish exports of the Solomon Islands from CBSI reports

| | Fish exports | Total exports | Fish exports as a % of total exports |
|---|---|---|---|
| 2017 | 383 | 3,933 | 9.7% |
| 2018 | 448 | 4,529 | 9.9% |
| 2019 | 405 | 3,765 | 10.8% |
| 2020 | 357 | 3,113 | 11.5% |
| 2021 | 475 | 2,981 | 15.9% |

Units: Millions of SI$; Source: CBSI (2022)

The MFMR has an independent system for tracking fishery exports. According to staff of the MFMR, all fishery exports of Solomon Islands require a permit. Each export consignment is inspected, and the volume and value are recorded. Table 16-13 gives the MFMR exports. The items included in the table are primarily coast fishery products: beche-de-mer, corals, crustacea, dried tuna fishmeal, fish eggs, gastropods, inshore fish, oyster shell, seaweed, sea worm and shark fin.

Table 16-13: Summary of the MFMR Fishery Export Database

| | Pieces (no.) | Volume (kg) | Total value (SI$) |
|---|---|---|---|
| 2015 | 94,026 | 1,232,098 | 34,996,360 |
| 2016 | 84,851 | 906,334 | 11,347,421 |
| 2017 | 31,105 | 1,395,495 | 40,705,314 |
| 2018 | 75,414 | 771,101 | 24,724,234 |
| 2019 | 37,691 | 535,072 | 11,733,346 |
| 2020 | 31,000 | 701,538 | 3,715,097 |
| 2021 | 26,470 | 280,825 | 4,063,495 |

Units: Some items are measured in pieces, others in volume
Source: MFMR unpublished data

The harvesting of beche-de-mer has a major impact on the value of coastal fishery exports. During 2018, the season was open and SI$19 million of exports of beche-de-mer were reported.

## 16.4 Government revenue from fisheries

### Access fees for offshore fishing

The MFMR 2020 annual report gives the access fees received for offshore fishing activity in 2020[5] (Table 16-14). The "FFA Receipts" in the table are the proceeds from the U.S. Tuna Treaty (not including the project development fund component).

**Table 16-14:** Access fees received for offshore fishing in 2020

| Type of activity | SI$ |
|---|---|
| Fisheries license fees (overseas) | 194,980,848 |
| Fisheries license fees (local) | 59,822,915 |
| FFA receipts | 24,087,232 |
| PNA (FSM) fishing licence fees | 60,096,154 |
| **Total** | **338,987,149** |

Source: MFMR (2021)

The total government revenue for 2020 was SI$3,799 million (CBSI 2022). The access fees for offshore fishing therefore equate to 8.9% of total government revenue.

### Other government revenue from fisheries

The MFMR 2020 annual report gives the 2020 revenue (apart from the access fees given above) received by the MFMR (Table 16-15).

**Table 16-15:** Other government revenue from fisheries in 2020

| Source of revenue | SI$ |
|---|---|
| Export permit fees | 48,300 |
| Fish processing licence fees | 616,356 |
| Port entry fees | 139,500 |
| Fish and miscellaneous sales | 518,500 |
| Transshipment levies | 2,541,779 |
| Observer and services fees | 3,569,324 |
| **Total** | **7,433,759** |

Source: MFMR (2021)

[5] 2021 access fees are not yet available.

The MFMR 2020 Annual report (MFMR 2021) contains the statement:

> Each year the MFMR is expected to collect revenue for the country. In 2020 the estimated revenue projection was 369 million. However, the Ministry managed to collect a total revenue of about SB$346 million [the total of the two tables above]. This is a major achievement despite the impact of COVID 19 in 2020.

## 16.5 Fisheries-related employment

Three types of fisheries-related employment information for Solomon Islands is presented here: data on informal employment, formal employment and gender aspects of fisheries work.

Informal employment in the fisheries sector is extremely important in Solomon Islands, but the available data is fragmented. One of the most comprehensive statements is contained in an older report by the Asian Development Bank (2014):

> The number of subsistence fishers in Solomon Islands can be crudely estimated by looking at the total population – about 570,000 in 2012 – and assuming 82% as the rural population. By dividing this by the average number of household members in rural households (5.2 persons) the minimum number of subsistence fishers can be derived. A minimum of 88,000 people are estimated to be engaged in fishing, assuming one household member is a fisher. This, however, is a conservative estimate. If the inputs of women and other adult men are considered in the estimate, the number of subsistence fishers would double to 175,000.

The results of the 2019 Population and Housing Census for Solomon Islands (which should have fisheries employment information) are not yet available. The two most recent national censuses occurred in 1999 and 2009. The report of the 2009 census (NSO 2010a) shows "changes in paid employment" in the 10-year period between the two surveys, as follows:

- 1999: total jobs in fishing were 3,367 (2,935 males and 432 females)
- 2009: total jobs in fishing were 5,736 (5,076 males and 660 females)
- Changes during the period: 70.4% increase in paid employment in fishing (72.9% increase for males and 52.8% increase for females)

The 2012/13 household income and expenditure survey (SINSO 2015) is the most recent HIES for which the results are available. The survey indicates:

- Fishing produces about 10% of all household income in the Solomon Islands, including cash income and imputed subsistence income.

- 48.4% of all households in the country undertake subsistence fishing activities.
- Curiously, the HIES only shows 313 people employed in "fishing". It is likely that this is confined to only the formal fishing jobs, such as those aboard the industrial-scale fishing vessels (i.e. the purse seiners and pole-and-line vessels).

An IUCN study (Arena et al. 2015) states that the 2009 HIES reported that the number of workers in fisheries and aquaculture was 5,756 (12% female and 88% male). This figure has not changed significantly since 2001 and 2004 when there were 5,179 and 5,114 formal jobs in the fishery sector, respectively.

Another aspect of fisheries-related employment in Solomon Islands is jobs with MFMR. The 2020 MFMR Annual Report (MFMR 2021) reports there were 2015 jobs in the Ministry in 2020, including established staff, non-established staff, observers and contractors.

FFA tracks formal tuna-related employment in the region, including for Solomon Islands. The FFA Tuna Report Card (FFA 2022a) indicates that there was an annual average of 3,356 tuna-related jobs in the Solomon Islands over the three-year period 2018–2020, including processing, harvesting, observers and MFMR staff. Solomon Islands has about 15% of all such jobs in all the FFA member countries.

Some gender aspects of employment in the Solomon Island tuna industry are given in Box 16-1.

**Box 16-1:** Gender aspects of employment in the Solomon Island tuna industry

Women make up two thirds of the SolTuna cannery workforce, with most of these being the women cleaning and preparing fish loins for canning. As is usual in seafood processing globally, these processing line workers are almost all women. Other manual labour roles in the factory involving heavy lifting or machinery have been filled mainly by men. Women work in quality control technical roles and are prominent in low- to mid-level administrative roles. Until 2019, only men have been employed on the industrial fishing vessels, as is usual on industrial tuna fishing vessels worldwide, but in 2019 three women started as cadets in the fishing fleet. Some women are involved in the onshore servicing and managing of fishing vessels. Most senior managers have been men, but there have also been women senior managers. Since the cannery first started in Noro in the early 1990s, it has been an important opportunity for rural women with low levels of schooling to enter the formal economy. The importance of these opportunities is heightened by the fact that rural employment sits at only 13% on average, with rural women's employment rates much lower than this.

Source: Adapted from Barclay et al. (2019)

A general feature of the information on formal employment related to fisheries in Solomon Islands and other countries of the region is that the definition of the "number of jobs" is vague. It is not known whether it is the total number of people to have worked during a year, the number at a point in time or the number of full-time equivalent jobs – or a mixture of the three. This issue makes it difficult to track fisheries-related employment over time and across countries.

## 16.6 Levels of fishery resource consumption

The following summarise the older estimates of annual per capita consumption of fish in Solomon Islands:

- Skewes (1990) found that 31% of households consumed fresh fish each day, and that 82.4% of meals containing animal protein were fish based. The consumption of fish was estimated to be 45.5 kg.
- A Japan-sponsored study in 1994 (JICA undated) found that Honiara households consumed 47.9 kg of fresh fish per day, and that the figure for households in provinces was 65 kg.
- Preston (2000) estimated that country-wide consumption for 1995 was 32.7 kg/person/year.
- The Food and Agriculture Organization (FAO) Food Balance sheet for 1999 estimated that household consumption, country-wide, was 32.2 kg.

Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. For Solomon Islands, the per capita fish consumption for the period (whole weight equivalent) was 45.5 kg per year in urban areas (fresh fish comprised 80% of this amount) and 31.2 kg per year in rural areas (90% fresh fish). The national fish consumption rate was 33.0 kg per capita per year.

There is considerable variation in per capita fish consumption across the country. This is demonstrated by SPC's PROCFish survey, which aimed to survey typical fishing villages. The annual fish consumption at each of the four villages chosen was around 100 kg/person, which is three times the national consumption figure cited by Bell et al. (2009b), above.

A report on food consumption in Solomon Islands (Troubat et al. 2021) gives information on the dietary contribution of fish (Box 16-2).

**Box 16-2:** The dietary contribution of fish in the Solomon Islands

In the Solomon Islands fresh fish remains a relatively affordable source of energy compared to meats: the cost of acquiring 1 000 kcal from fish is one third of that for meat. Sugar and confectionery are low-cost sources of energy: it costs the same to acquire 1 000 kcal from sugar as 1 000 kcal from kumara. While the latter is part of the recommended sources of energy, the former is to be avoided. Among protective foods, breadfruit is the least expensive source of energy. At a national level, the contribution of proteins, fats and carbohydrates are all within WHO-recommended norms for a balanced diet. However, not all households have access to a balanced diet, as fewer than one household in five reach adequate amounts of proteins, fats and carbohydrates. Fish represents almost 30 percent of the total proteins consumed; however, proteins from pulses/seeds/nuts are a more affordable source of protein than fish, while proteins from beef were four times as expensive as those from fish.

Source: Troubat et al. (2021)

Farmery et al. (2020) describes a study of aquatic foods and nutrition in the Pacific. That study used a variety of types of information, including nutrient composition data from the newly created Pacific Nutrient Database, national-level data on aquatic food consumption from household income expenditure surveys, village-level data on women's food consumption, and trade data from the newly developed Pacific Food Trade Database. The apparent mean daily per capita consumption of aquatic foods for Solomon Islands for 2011/12 is shown in Table 16-16.

**Table 16-16:** Mean daily per capita consumption of aquatic foods in the Solomon Islands

| Aquatic food group | National | Rural | Urban |
|---|---|---|---|
| Pelagic fish | 53.2 (1.51) | 56.1 (1.92) | 45.8 (2.08) |
| Reef fish | 97.5 (2.33) | 116.1 (3.07) | 50.9 (2.30) |
| Canned fish | 13.5 (0.22) | 9.2 (0.19) | 24.3 (0.49) |
| Shellfish | 30.7 (1.26) | 39.0 (1.67) | 9.7 (1.04) |
| Mixed fresh/frozen fish | 6.3 (0.60) | 8.3 (0.82) | 1.2 (0.38) |
| Aquatic food (total) | 201.2 (3.45) | 228.8 (4.52) | 131.8 (3.70) |

Source: Farmery et al. (2020); Edible portion in grams ± standard error

The Solomon Islands 2012/13 HIES (SINSO 2015) indicates that of all household expenditure on food, non-alcoholic beverages, alcoholic beverages, tobacco and narcotics, 17.8%[6] is for "fish and seafood".

[6] Both cash expenditure and imputed expenditure of home-produced products.

The domestic use of various types of fish from offshore industrial vessels is important in the Solomon Islands – and is probably greater than for any other Pacific Island country. Accordingly, this topic deserves additional attention.

- Based on the 2005/06 HIES, in both urban and rural areas processed fish, particularly second-grade canned Taiyo tuna, represents almost 50% of all expenditure on fish (Weeratunge et al. 2011).
- The salt fish trade in Honiara consists of selling, from tuna transshipment operations, the non-target bycatch and damaged target tuna that are otherwise unmarketable. McCoy (2013) indicates that this trade puts about 440–500 t of fish onto the Honiara market annually. This is approximately equivalent to each of the 100,000 residents of Honiara consuming 4.7 kg of salt fish per year.
- Tolvanen et al. (2019) give information on the sales of bycatch and undersize tuna by the Solomon Islands National Fisheries Developments. It is stated that in 2018, 855 t of tuna and 164 t of bycatch were sold domestically.[7]
- Tolvanen et al. (2019) also indicate that 2,334 t of canned dark-meat tuna was sold domestically in 2016.

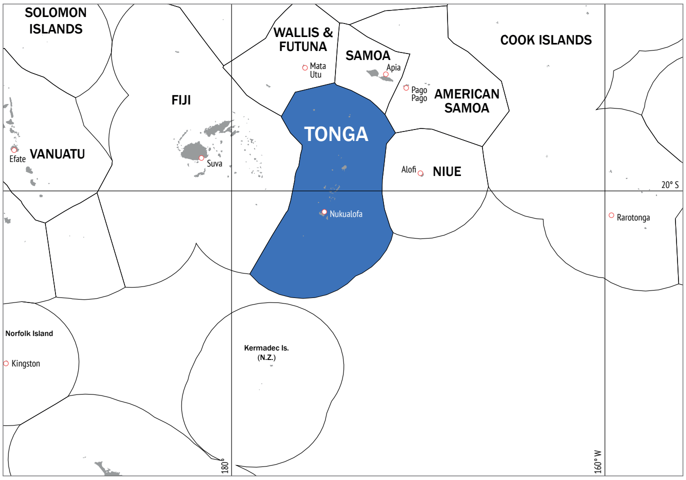
## 16.7 Exchange rates

The average yearly exchange rates (Solomon Islands dollar [SI$] to the US dollar) used in this book are:

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|
| 7.63 | 8.16 | 7.99 | 7.75 | 8.02 | 8.30 | 8.02 | 8.05 | 8.19 |

[7] Some of these quantities could include salt fish mentioned in the point above.

# 17 Tonga




## 17.1 Volumes and values of fish harvests in Tonga

### Coastal commercial catches in Tonga

Historical attempts to estimate total coastal fisheries production in recent years have been as follows:

- Dalzell et al. (1996) estimated that subsistence production in the early 1990s was 933 tonnes (t) worth US$1,901,208, and that the coastal commercial production was 1,429 t, worth US$2,806,641.
- The Tonga Statistics Department, using a household income and expenditure survey (HIES), determined that the value added for local market fisheries in the late 1990s was T$9,090,000 (Tongan Pa'anga), and for non-market fisheries it was T$5,108,000 (Tonga Statistics Department unpublished data). This value added equates to 2,863 t for non-market fisheries and 3,561 t for local market fisheries.
- Gillett and Lightfoot (2001) estimated that in the late 1990s, the coastal fisheries production comprised subsistence of 2,863 t, worth T$6,385,000, and coastal commercial of 4,173 t, worth T$17,362,500.

Gillett (2009a) considered the above studies and examined the results of the 2000/01 HIES. The results of the HIES gave volumes and values of coastal fisheries production that seemed too low and were rejected for a number of reasons. It was decided that the most appropriate option for estimating fishery production would be to adjust the Gillett and Lightfoot (2001) estimate by changes in population, coastal fisheries exports, imported food and the price of fish. Gillett (2009a) subsequently estimated a production in 2007 from Tonga's coastal commercial fisheries of 3,700 t (of which about 700 t was exported), worth about T$22,800,000 to the producer. Following a similar extrapolation approach for subsistence fisheries, a 2007 production of about 2,800 t, worth T$12,488,000, was also estimated.

A study by the International Union for the Conservation of Nature (IUCN) that has considerable relevance to valuing the benefits from coastal fisheries in Tonga was carried out under the Marine and Coastal Biodiversity in Pacific Island Countries (MACBIO) Programme (Salcone et al. 2015). The MACBIO Tonga fishery results can be placed in three categories:

- For *subsistence fisheries*, the MACBIO study used information from the 2009 HIES to estimate the gross annual value of subsistence fishing in Tonga at between T$6,063,000 and T$10,914,000 per year. Using an average price of seafood, that value equates to between 733 t and 1,320 t of fishery products.
- For *small-scale coastal commercial fishing*, the MACBIO study used expenditure on seafood and household income from fishing together with seafood prices to estimate commercial production of between 1,008 t and 1,826 t.
- For *export-oriented coastal fisheries*, the MACBIO results show values added for: (a) beche-de-mer of T$450,000, based on export prices and a 50% value-added ratio; (b) aquarium products of T$250,000, based on prices minus various taxes and estimated operating costs; and (c) deep-slope fisheries of T$230,000, based on the gross value of exports and non-exports and a 20% value-added ratio.

A study in 2015/16 (Gillett 2016) considered the MACBIO study in detail, but for several reasons adopted a different approach, enhancing the Gillett (2009a) estimate by taking into account additional information and developments in the period from 2007 to 2014 that are likely to have affected coastal fisheries production. These include factors such as cyclones, population change, use of fish aggregation devices, sea cucumber harvests, developments in the deep-slope fishery and changes in the price of fish. An examination of those factors suggested that overall, there was no radical change during the period 2007–2014 in the production from Tonga's coastal fisheries. The most likely scenario was thought to be a moderate increase in the volume and a slightly greater increase in the value of coastal fisheries. It was therefore estimated that in 2014 Tonga's coastal commercial fisheries produced 3,900 t of fish, worth T$33.6 million to fishers.

For making new estimates of coastal fisheries production in Tonga, it is important to note:

- Surveys by the Ministry of Fisheries estimate the volumes and values of the throughput of certain fish markets and of exports. This approach can give information on trends in production but not volumes and values of national coastal fisheries production.
- It is difficult to use the publicly available data from household income and expenditure surveys (e.g. the report of the 2015/16 HIES [TSD 2017]) for making estimates of 2021 coastal fish production.

Some features of Tonga's coastal commercial fisheries that are relevant to making estimates of production for 2021 are:

- The condition of fishery resources has a major effect on the production of the various fisheries. A Pacific Community (SPC) survey of finfish in Tongatapu (Moore and Malimali 2016) includes the following statement: "recent surveys suggest that the coastal finfish resources of Tongatapu are moderately to seriously overexploited, with significant declines in abundance observed for some species and decreases in size for others." Another SPC report (SPC 2019d) indicates that "the lack of conservation strategies, no enforcement of limits, and overfishing has led to the collapse, near collapse or near extinction of several fisheries in Tonga. These include beche-de-mer, mullet, coconut crabs and devil clams."
- In the period 2014–2021, the import of alternatives to fish increased. The import into Tonga of "meat and edible offal, fresh chilled or frozen" increased by 42% in real terms during the period (SDT 2015; SDT 2022).
- The use of tuna and bycatch from offshore longlining (i.e. non-coastal resources) is increasing. The non-communicable disease (NCD) project, which started in 2016, is aimed at combating NCDs in Tonga with tuna at an affordable price. In the 2020/21 financial year, as part of the project, a total of 152 t of tuna was sold locally (MOF 2021). Apart from the NCD project, a significant amount of longline tuna and bycatch is offloaded in Tonga but not exported. A report by the Ministry of Fisheries (MOF 2022a) shows that in the period 2011–2020, from 231 to 3,500 t of tuna was offloaded annually but not exported, increasing the supply of fish in Tongatapu – and presumably reducing the demand for coastal fish.
- The population of the country declined about 2.8% in the period 2014–2021 (SPC/SDD).

- The most significant coastal export fisheries are for snapper, aquarium products and sea cucumber. The volume of snapper exports in 2020 was about the same as in 2014 but dropped to zero in 2021 due to Covid. The number of pieces of aquarium exports dropped 33% in the period. Sea cucumber exports decreased from 10.6 million pieces in 2014 to 2.3 million in 2021 (MOF unpublished data).
- The spikes in the production of sea cucumbers reflect the history of the moratoriums on the fishery (Box 17-1), and due to the very high value of sea cucumbers, those moratoriums have a major impact on the value of the coastal fisheries in the country.

**Box 17-1:** Sea cucumber moratoriums in Tonga

Exports of beche-de-mer from Tonga were steady in the 1990s until 1996 when a survey to assess the effect of the fishery on standing stocks showed significant declines in sea cucumber populations, particularly for high value species. As a result, the Government of Tonga closed the sea cucumber fishery for 10 years to allow stocks to recover, effective from 31 December 1997. A follow-up survey in 2004 found that stocks, with the exception of the slow-growing black teatfish Holothuria whitmaei, had recovered sufficiently to reopen a sustainable small-scale fishery, provided that an appropriate fisheries management plan was developed and implemented. The sea cucumber fishery was therefore reopened in 2008, only for stocks to decline to their lowest recorded densities. Export data showed that as high value species were depleted, catches of medium and low value species increased, including species that were previously caught for subsistence only (e.g. snakefish, dragon fish). In March 2011, the recorded declines prompted preliminary advice from SPC to the Ministry of Fisheries, recommending the closure of the fishery for a minimum of three to five years to allow stocks to recover. However, the fishery remained open for another five seasons from 2011 to 2015, which subsequently reduced existing breeding populations of all low, medium, and high value species, thereby prolonging the time required for stocks to recover. During these five seasons, the Ministry also increased the length of the open season, which placed further pressure on remaining stocks. Despite the prolonged fishing season, exports declined, prompting the Ministry to place another moratorium on the fishery in October 2015.

Govan and Bertram (2020) report no sea cucumber exports from Tonga in the period 2015–2019. Staff of the Ministry of Fisheries indicate that sea cucumber fishing was open from July 1 to September 30, 2020 and from May 7 to September 30, 2021. The Ministry of Fisheries annual reports state that a total of 3.6 million pieces of sea cucumber weighing 102 tonnes were exported from mid-2020 to mid-2021, and for mid-2021 to mid-2022 4.2 million pieces weighing 91 tonnes were exported.

Source: Adapted from Shedrawi et al. (2020), Govan and Bertram (2020), MOF (2021) and Ministry of Fisheries staff

There are various perspectives of the impact of Covid on coastal fisheries. As mentioned above, Tonga's important export-oriented snapper fishery had no exports in 2021. An SPC survey (Marre and Imhof 2021) found that while most special management area (SMA[1]) households reported an unchanged level of fishing effort or catches as compared to before COVID-19, most small-scale fishers reported reduced fishing effort. Half of SMA households and almost all small-scale fishers reported making less income from fishing due to numerous factors but also an increase in home consumption of seafood. A survey in Vava'u (LMMA and VEPA 2020) found that there was an increase in both fishing and farming activities during the Covid period. By contrast, staff of the Ministry of Fisheries indicate that the impact of Covid on coastal commercial fisheries, except for snapper, was not great (i.e. fishers were allowed to go fishing) and certainly much less than that of the volcanic eruption in January 2022. Remittances from overseas are important in Tonga, and there was "an increase in remittance inflows of 36% in financial year (FY) 2021, as the Tongan diaspora supported their families" (IMF 2022).

The price of fish in 2021 was estimated from a variety of sources: raw market data, an analysis of prices in domestic fish markets of the three main island groups, the Ministry of Fisheries annual report for 2020/21 and the Ministry's quarterly report for the second quarter of 2021. Market prices for all finfish and invertebrates in Tongatapu markets averaged T$9.69 per kg in 2021, with prices 5% less in Vava'u and 10% less in Ha'apai. The high-value snappers, aquarium products and sea cucumbers are generally not available in the domestic markets – but would increase substantially average prices paid to fishers. For the purposes of the present study, the national price to fishers for all fishery products for 2021 is taken to be T$9.50 per kg.

Almost all of the factors mentioned above would tend to decrease coastal fisheries production in the 2014–2021 period: an increase in the amount of food alternatives to coastal fish, Covid affecting export markets, the depletion of coastal fishery resources and a large harvest of sea cucumber in 2014. Apart from increased remittances, significant factors that would tend to promote an increase in coastal commercial production during the period are not apparent.

It is estimated that in 2021 Tonga's coastal commercial fisheries produced 3,500 t of fish, worth T$33.2 million to fishers. The poor factual basis of this estimate should be recognised.

1 Special Management Areas (SMAs) are arrangements whereby coastal communities are granted differential access to adjacent fishery resources and some authority to manage fisheries in the area.

## Coastal subsistence catches

Many of the factors mentioned above affecting production are applicable to Tonga's subsistence fisherie – except that Covid is likely to have substantially promoted production.

Following from the discussion in the previous section, it is estimated that the volume of production from coastal subsistence fisheries in Tonga in 2021 was about 3,500 t. Based on the farm gate method of valuing subsistence production (i.e. discounting by 30%), this is worth T$23.3 million to fishers. The poor factual basis of this estimate should be recognised.

## Locally based offshore catches

In 2021 the Tonga national fleet consisted of four national longline vessels (MOF 2022). It is assumed that these vessels make up the locally based fleet, while the nine foreign flagged vessels cited in MOF (2022b) are not locally based.[2] The catches by the fleet are given in Table 17-1.

**Table 17-1:** Tuna and bycatch catches of the Tonga national fleet

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Albacore | 27 | 23 | 30 | 13 | 10 |
| Bigeye | 24 | 34 | 16 | 10 | 14 |
| Skipjack | 12 | 4 | 2 | 3 | 1 |
| Yellowfin | 374 | 201 | 187 | 155 | 203 |
| Sub-total tuna | 437 | 262 | 235 | 181 | 228 |
| Bycatch | 102 | 116 | 130 | 49 | 62 |

Source: MOF (2022b); Units = tonnes

The report by Tonga's Ministry of Fisheries to the 2022 meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission (MOF 2022) states:

> With the ongoing disruption of COVID-19 restrictions and border closures, the Ministry of Fisheries made every effort to keep this fishery going. As a result, the National fleet unexpectedly shows an increase in its total catch harvested and exported in 2021, despite the decrease in the number of active vessels and number of trips.

Using prices from the Forum Fisheries Agency (FFA 2022b) and adjusting those destination market prices to be Tonga dock-side prices and accounting for the value of the bycatch equates to T$3.4 million for the 290 t of tuna and bycatch in 2021.

2 If this assumption is incorrect, the catches in this section (and the GDP section) need to be adjusted.

## Foreign-based offshore catches

The report by Tonga's Ministry of Fisheries to the 2022 meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission (MOF 2022b) states:

- In 2021, 10 foreign-flagged longline vessels were licensed to fish in Tonga's exclusive economic zone (EEZ) compared to 11 vessels in 2020.
- Those foreign vessels were registered in Fiji and in Taiwan.
- The annual tuna and bycatch harvest for the foreign-flagged vessels in 2021 was 1,759 tonnes, a decrease of 11 % compared to 1,958 tonnes in 2020.
- In 2021, 1,519 tonnes of the catch (86%) was tuna, while 240 tonnes was bycatch.

Using prices from FFA (2022b) and adjusting those destination market prices to be Tonga in-zone prices and accounting for the value of the bycatch equates to T$21.9 million for the 1,759 t of tuna and bycatch.

## Freshwater catches

The freshwater catches in Tonga are extremely small because of the lack of large freshwater bodies. The Tonga Fisheries Resource Profiles (Bell et al. 1994) makes no mention of freshwater fish or fisheries, but the Tonga Fisheries Bibliography has a section called "Fresh and Brackish Water" (Gillett 1994a).

Catches of fish in freshwater appear limited to tiny quantities of tilapia in small lakes in the three northern island groups of the country. It is reported that a small stream on 'Eua Island has freshwater shrimp (J. Fa'anunu, per. com. November 2008). Tilapia was introduced into some of the wells on Ha'ano Island in Ha'apai (Thaman et al. 1995).

The Tonga freshwater fish catch in 2021 is deemed to be 1 t, worth T$6,650.

## Aquaculture harvests

A recent regional review of aquaculture (IAS 2022) commented on aquaculture in Tonga:

- Current species cultivated commercially: Seaweed – Cladosiphon sp "Limu Tanga'u" collected from wild. Quality control problems, destruction from recent volcano. Corals and others for the aquarium trade. Slowed during Covid due to transport difficulties. Only two companies still operated during Covid. Wing Pearl oyster for mabe pearls – nascent. Delayed by Covid. Markets locally and in Hawaii. Some production. World Bank gives 20 tonnes as production in 2018.

- Current species used for food security & small-scale community-based production: Giant clams in communities. Government hatchery. Various species. Sea cucumber from a joint venture distributed to communities all over the country, pilot scale.
- Other species attempted or planned: Giant clam reseeding. Pearl oysters, mussels (not adapted to the climate), trochus and green snail for reseeding, mullet (wild fry), sea grapes and sea urchin.

During the present study, discussions were held in November 2022 with the aquaculture staff of the Ministry of Fisheries. In terms of current aquaculture production, those discussions indicated that the only "real commercial aquaculture production" is that for mabe pearls. In 2021 there were 26 licensed mabe pearl farmers, all but one in Ha'apai and Vava'u. Aspects of mabe culture are given in Box 17-2. Assuming an average annual production of 1,000 shells per farm and a farm gate price of T$30 per shell, that equates to T$780,000. Other current aquaculture activities in the country, as per the aquaculture staff, are:

- Giant clam. The Ministry spawned giant clams for grow-out by the aquaculture industry and for stocking the Special Management Areas – but none have been produced in the last two years.[3]
- Sea cucumber. The Ministry has an arrangement with the Vast Ocean company for experimental culture in which the company does the spawning and gives 10% of what is spawned to the Ministry – about 9,000 individuals in recent years.
- Milkfish. There was an FAO project during the years 2014–2016 on Nomuka Island for re-stocking, but there is currently no production.
- Tilapia. Culture has just begun at the Ministry.
- Coral. Some coral is being cultured by aquarium companies in the tanks at the Ministry.

**Box 17-2:** Mabe culture in Tonga in 2018

About 23 farms are involved in the farming of mabe, which is marketed locally and targets the domestic market, especially the tourism sector. Mabe farming is a well-established sector with second-generation farmers. Farms have been established in Vava'u, where the activity started, and more recently around Tongatapu and Ha'apai. The mabe sector is well structured, with an ongoing research programme funded by the Australian Centre for International Agricultural Research, seed supply from the Sopu hatchery and a Pearl Farmers Association among the advancements to date.

Source: MOF (2018)

[3] The unpublished report "Ministry of Fisheries Revenue for 2021–2022" shows that a total of T$282 was received by the Ministry in financial year 2021/22 for "sale of clams".

Using the above production information, the aquaculture production of Tonga in 2021 can be estimated to be 35,000 pieces, with a farm gate value of T$1 million.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values[4] of the fishery and aquaculture harvests in Tonga in 2021 can be made (Table 17-2).

**Table 17-2:** Annual fisheries and aquaculture harvest in Tonga in 2021

| Harvest sector | Volume (t and pcs, where indicated) | Value (T$) |
|---|---|---|
| Coastal commercial | 3,500 | 33,200,000 |
| Coastal subsistence | 3,500 | 23,300,000 |
| Offshore locally based | 290 | 3,400,000 |
| Offshore foreign-based | 1,759 | 21,900,000 |
| Freshwater | 1 | 6,650 |
| Aquaculture | 35,000 pcs | 1,000,000 |
| **Total** | **9,050 t and 35,000 pcs** | **82,806,650** |

The factual basis for the estimates of coastal commercial and coastal subsistence catches is extremely weak.

[4] The values in the table are dockside/farm gate prices.

Figures 17-1 and 17-2 show the volumes and values of Tonga fisheries production in 2021. Aquaculture is not shown in the volumes figure due to the use of mixed units (pieces and tonnes).

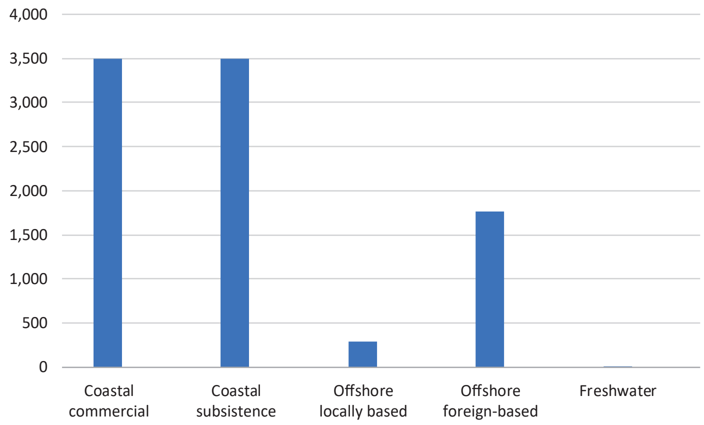



**Figure 17-1:** Tonga fisheries production in 2021 by volume (t)

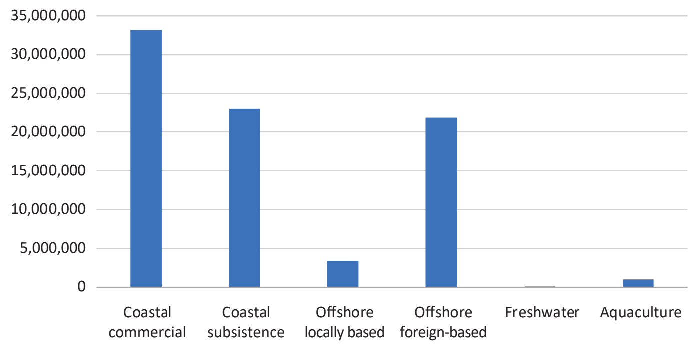



**Figure 17-2:** Tonga fisheries and aquaculture production in 2021 by value (T$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The estimated fishery production levels for Tonga from those four studies are presented in Table 17-3.[5]

[5] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

**Table 17-3:** Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (T$) |
|---|---|---|---|
| Coastal commercial | 1999 | 4,173 | 17,362,500 |
| | 2007 | 3,700 | 22,800,000 |
| | 2014 | 3,900 | 33,600,000 |
| | 2021 | 3,500 | 33,200,000 |
| Coastal subsistence | 1999 | 2,863 | 6,385,000 |
| | 2007 | 2,800 | 12,488,000 |
| | 2014 | 3,000 | 18,700,000 |
| | 2021 | 3,500 | 23,300,000 |
| Offshore locally based | 1999 | 800 | 5,880,000 |
| | 2007 | 1,119 | 6,224,625 |
| | 2014 | 1,363 | 7,770,000 |
| | 2021 | 290 | 3,400,000 |
| Offshore foreign-based | 1999 | 45 | 166,000 |
| | 2007 | 0 | 0 |
| | 2014 | 1,891 | 9,408,000 |
| | 2021 | 1,759 | 21,900,000 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 1 | 4,000 |
| | 2014 | 1 | 6,000 |
| | 2021 | 1 | 6,650 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 12,334 | 37,000 |
| | 2014 | 1,291 pcs | 28,000 |
| | 2021 | 35,000 pcs | 1,000,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

## 17.2 Contribution of fishing to GDP

### Current official contribution

The Tonga Statistics Department's "National Accounts Statistics 2020-21" (TSD 2022b) gives the fishing sector contribution to GDP (Table 17-4).

**Table 17-4:** Tonga fishing sector contribution to GDP

| | 2017/18 | 2018/19 | 2019/20 r | 2020/21 p |
|---|---|---|---|---|
| Fishing | 18,962 | 21,979 | 23,594 | 23,421 |
| Tonga GDP | 1,072,556 | 1,163,344 | 1,119,952 | 1,068,862 |
| Fishing as a % of Tonga GDP | 1.8% | 1.9% | 2.1% | 2.2% |

T$ thousands; current market prices; r = revised; p = provisional

### Method used to calculate the official fishing contribution to GDP

The staff of the Tonga Statistics Department kindly provided unpublished data that shows the components of the fishing contribution to GDP (Table 17-5). In the table, fishing contribution is made up of the value added for marketed fishery products (#3 in the table below), the value added for non-marketed fishery products (#4) and the value added for exported fishery products (#6). These three components added together forms the fishing sector contribution to GDP (#7).

**Table 17-5:** Components of the fishing contribution to GDP

| | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|
| **Value of domestic consumption** | | | | |
| 1. Marketed consumption in current prices | 12,677 | 12,835 | 15,011 | 14,999 |
| 2. Non-marketed consumption in current prices | 6,747 | 6,831 | 7,989 | 7,983 |
| **Total consumption current prices** | 19,424 | 19,666 | 23,000 | 22,982 |
| Value added domestic consumption | | | | |
| 3. GVA marketed in current prices | 10,141 | 10,268 | 12,009 | 11,999 |
| 4. GVA non-marketed in current prices | 6,072 | 6,148 | 7,190 | 7,185 |
| **Total GVA in current prices** | 16,214 | 16,415 | 19,199 | 19,184 |
| **Exports of fish** | | | | |
| 5. Exports in current prices | 4,433 | 8,973 | 7,088 | 6,834 |
| 6. Exports value added in current prices | 2,749 | 5,563 | 4,395 | 4,237 |
| **7. Total value added of fishing sector** | **18,962** | **21,979** | **23,594** | **23,421** |

Units = T$ thousands; GVA = gross value added

According to the staff of the Tonga Statistics Department, the general method for calculating sector contributions to GDP, including that from fishing, has been used for many years – with the only change recently being the benchmark year, which is now 2019. The method used for fishing is to subdivide the sector into three components:

- Local market. This category covers the fish that are caught for sale as food. The staff of the Tonga Statistics Department indicated that a production approach is used to estimate the value added by the locally marketed sub-sector. The data are obtained from the latest HIES. This value is updated by extrapolation, based on population, consumer price index and a disaster index. Twenty percent of the gross value is subtracted to account for intermediate costs.
- Non-marketed. This category covers the fish and aquatic products that are harvested for household use. The value added is estimated from information obtained in a HIES. In the years following a HIES, the estimated GDP contributions have been derived by extrapolation, based on population, the consumer price index (CPI) and disaster index. Ten percent is deducted from the gross output to account for intermediate costs.
- Export. The export contribution to estimated GDP comes from the Reserve Bank exports statistics. According to the Statistics Department, the total value of fisheries exports is reduced by 35% to account for the costs of intermediate inputs.

## Alternative estimate of fishing contribution to GDP

Table 17-6 (below) represents an alternative to the official method of estimating fishing contribution to GDP in Tonga. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 17.1 above (summarised in Table 17-2) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by the use of specialised studies (Appendix 3).

It is not intended that the approach in Table 17-6 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

Table 17-6: Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production ($T) | VAR | Value added ($T) |
|---|---|---|---|
| Coastal commercial | 33,200,000 | 0.60 | 19,920,000 |
| Coastal subsistence | 23,300,000 | 0.75 | 17,475,000 |
| Offshore locally Based | 3,400,000 | 0.20 | 680,000 |
| Freshwater | 6,650 | 0.95 | 6,318 |
| Aquaculture | 1,000,000 | 0.55 | 550,000 |
| **Total ($T)** | **60,906,650** | -- | **38,631,318** |

Source: Table 17-2 and consultant's estimate

The total value added from fishing in Table 17-6 (T$38,631,318) for the calendar year 2021 is much larger than the official estimate of T$23,421,000 for the fiscal year 2020/21.

A comparison of the tables "Components of the fishing contribution to GDP" (Table 17-5) and "Annual fisheries and aquaculture harvest in Tonga in 2021" (Table 17-2) shows that most of the difference between the two estimates of the fishing contribution to GDP is due to the difference between the gross value of non-marketed fishery products in the official estimate and the equivalent category in the alternative estimate (coastal subsistence). The factors that could be responsible for this difference include:

- Obviously, the time periods are different (fiscal year 2020/21 vs calendar year 2021), but this should not create such a large difference.
- In the official estimate, the value of non-marketed consumption was almost identical in 2019/20 and 2020/21. In the alternative estimate, the value of the production of coastal subsistence fisheries was thought to increase due to Covid (i.e. economic hardship would lead to more subsistence fishing).
- Probably most of the difference between the value of non-marketed fishery products (official approach) and the value of commercial subsistence production (alternative approach) is the way the two categories were estimated. The official approach used the HIES, whereas the alternative approach (and previous studies involving Tonga: Gillett [2016], Gillett [2009a]) advanced several reasons why the Tonga HIES may underestimate fishery production.

## 17.3 Exports of fishery production

The fish exports of Tonga (Table 17-7) are given in the document "International Merchandise Trade Statistics" (TSD 2022a).

**Table 17-7:** Fish exports of Tonga

| | 2020 | 2021 |
|---|---|---|
| Fish | 7,581,054 | 4,218,282 |
| of which: Yellowfin tunas (fresh or chilled) | 701,027 | 672,897 |
| Bigeye tuna (fresh or chilled) | 26,212 | 90,014 |
| Other fish fresh or chilled | 6,853,815 | 3,455,370 |
| Crustaceans and molluscs and other invertebrates | 2,873 | 9,123 |
| Seaweeds and other algae | 269,108 | 434,170 |
| All fish, invertebrates and seaweed | 7,855,055 | 4,663,596 |
| Total Tonga exports | 33,524,736 | 34,561,775 |
| Fish exports as a % of all Tonga exports | 23.4% | 13.5% |

Source: Adapted from TSD (2022a); Units = T$

Some comments should be made on the above table:

- The large percentage of fishery exports relative to all exports for 2020 should be noted.
- When compiling fish export data, it is often confined to the Harmonized System (HS) category HS 03[6], which is "fish and crustaceans, molluscs and other aquatic invertebrates". As seaweeds are considered an important fishery export of Tonga[7], the category "seaweeds and other algae" was added to the table.
- There was a large drop in fishery exports between the two years on the table. The export of snapper was responsible for much of the decrease. Due to Covid, snapper exports dropped to zero in 2021, hence the large change in "other fish fresh or chilled" in the table.
- By contrast, the export of tuna changed very little between the two years. The report prepared by the Ministry of Fisheries for the Western and Central Pacific Fisheries Commission states:

  > Despite the continuous worldwide pandemic of COVID-19, the tuna industry export indicates a very encouraging result as 2021 tuna export increases compared to 2020.

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6 The Harmonized System (HS) is an international numerical method of classifying traded products.

7 The 2021/2022 Annual Report of the Ministry of Fisheries indicates that mozuku seaweed was one of the top fishery exports of the country.

The GDP publication of the Tonga Statistics Department (TSD 2022b) comments on the impact of Covid on the fishery exports of the country:

> Tonga export for 2020-21 is down significantly by 48.9 percent mainly due to fall in the export of services and more importantly, factoring in the border closures due to COVID-19 pandemic. Goods exports decreased by 19.9 percent in 2020-21, this is due to a decline in exports of fruits and vegetables and fish which includes export of fish, kava, yams, watermelon, taro and squash because of border closures being implemented to protect the country from the COVID-19 pandemic outbreak.

## 17.4 Government revenue from fisheries

### Access fees for offshore fishing

An unpublished document by the Ministry of Fisheries "Ministry of Fisheries Revenue for 2021–2022" gives information on payments in the 2021/22 financial year, including those for access:

- Multilateral Tuna Treaty: T$2,217,744
- Foreign Fishing Vessel & Application: T$123,574
- Local Fishing vessels & Application:[8] T$42,715
- Tuna licence: zero

The above indicates that in FY 2021/22 Tonga received T$2,384,033 as access fees for offshore fishing. According to the website of the Tonga Statistics Department, in FY 2021/22 the total Tonga government revenue was T$467,787,000 (www.tongastats.gov.to/statistics). The access fees therefore equate to 0.5% of all government revenue for FY 2021/22.

### Other government revenue from fisheries

The Ministry of Fisheries document "Ministry of Fisheries Revenue for 2021–2022" gives information on all the income received by the Ministry. Apart from the access fees described above, T$1,179,374 was received for the following categories:

- Sale of Produce & products: sales of posters, supporting letters
- Sale of Produce & products: Aquaculture

[8] There is a possibility that a portion of this fee is for coastal commercial vessels.

- Sale of Other Produce & Product
- Licences
- Rentals/Resources rent

## 17.5 Fisheries-related employment

Tonga's most recent household income and expenditure survey has considerable relevance to fisheries-related employment. The document "Household Income and Expenditure Survey 2015/2016" (TSD 2017) mentions "fish" 147 times. Some of the notable results are:

- In total, 63% of households participate in agriculture, 13% in fisheries, 70% in livestock and 39% in handicrafts and home processed foods.
- The household participation in fisheries ranges from 6% in urban Tongatapu to 32% in Ha'apai.
- One percent of all household income in Tonga is derived from fishing activities.
- A total of 5% of all households derive cash income from fishing activities.
- Income from the sale of fisheries produce has declined by two thirds in the period 2009–2015.

The report of the 2015 Tonga National Agricultural Census (MAFFF 2015) contains a chapter on fisheries. It states that during the 12 months before the agriculture census in April 2015, a total of 2,360 households, or 15% of the total households in Tonga, engaged in fishing activities. The Niua region had the highest proportion of households engaged in fishing, 59% (159 households). This was followed by the Vava'u region which had 35% (835 households) engaged in fishing and the Ha'apai region at 34% (317 households). In the 'Eua region, only 11% of total households engaged in fishing. Although the Tongatapu region had the highest number of households engaged in fishing activities, this only represented 8% of its total households.

The Agricultural Census report also has information on relative participation in the subsistence, semi-subsistence and commercial sub-sectors (Table 17-8).

**Table 17-8:** Participation in various fishery sub-sectors in 2015

| Island divisions | Total | Subsistence | | Semi-subsistence | | Commercial | |
|---|---|---|---|---|---|---|---|
| | Households engaged in fishing activities | Number | % of total households | Number | % of total households | Number | % of total households |
| TONGA | 2,360 | 1,267 | 54% | 997 | 42% | 96 | 4% |
| Tongatapu | 980 | 376 | 38% | 520 | 53% | 84 | 9% |
| Vava'u | 835 | 590 | 71% | 236 | 28% | 9 | 1% |
| Ha'apai | 317 | 149 | 47% | 165 | 52% | 3 | 1% |
| 'Eua | 69 | 28 | 41% | 41 | 59% | 0 | 0% |
| Niuas | 159 | 124 | 78% | 35 | 22% | 0 | 0% |

Source: MFFF (2015)

There was a labour force survey in Tonga in 2018. The report of the survey (TSD 2018) is not very relevant to fisheries because all mentions of fisheries were combined with agriculture and forestry (e.g. "agricultural, forestry and fishery workers").

Employment in Tonga's tuna industry is covered in the Tuna Fishery Report Card 2022 (FFA 2022a), which states that over the period 2018–2020, an annual average of 283 people had tuna-related employment.

The gender aspect of fisheries-related employment was the subject of a study by SPC (SPC 2019d). A summary of the findings is given in Box 17-3.

**Box 17-3:** Gender roles in fisheries and aquaculture in Tonga

In Tonga, as in other Pacific countries, off-shore fishing is almost exclusively dominated by men, although women may work in the shore-based components of commercial operations. Women are engaged in subsistence fishing and gleaning and the Tonga Fisheries Sector Plan notes that, in some areas, women's subsistence gleaning activities account for over 75% of invertebrate harvests. Women also do small-scale marketing of fish and shellfish in the main markets and engage in some aquaculture activities, such as pearl farming. There is scope to involve women in all of these areas; proactive engagement, use of gender indicators in monitoring and evaluation, and documentation of lessons could highlight good practice and facilitate replication in multiple areas. Research done in 2002 found that about half the village women surveyed in Ha'apai were engaged in fishing for finfish. In Vava'u, information from the same study showed that between 6% and 21% of women fished. Women's fishing techniques varied in the areas surveyed and included net casting, spear fishing and using handlines. Numbers for gleaning were higher, ranging from 72% to 92%. Men also engaged in these activities but at different times of the day and for different durations. Women preferred fishing in the day, while men did night fishing. Women also spent slightly less time gleaning than did men. Men used different gear – handlines as well as all types of nets. Men also trolled and did deep-bottom fishing to harvest finfish, whereas women were not reported to use those techniques.

Source: SPC (2019)

## 17.6 Levels of fishery resource consumption

The major historical studies of fish consumption in Tonga are:

- The 1998 FAO/AusAID Fisheries Sector Review (Gillett et al. 1998) stated that the figures published for per capita fish consumption range from a low of 14.0 kg/year to a high of 102.0 kg/year (implying a production of 10,000 t). Assuming that all the production from inshore fisheries is eaten domestically, and that the best estimate of this in 1995 was 2,362 t, then this would provide a supply of 24.2 kg/year for the 1996 population of 97,500. Integrating the 575 t of imported canned fish gives an overall availability of 30.0 kg/year.
- The 2006 annual report of the Fisheries Department (Fisheries Department 2007) reports the results of an unpublished survey that was carried out in 2004–2005 in Tongatapu, Vava'u and Ha'apai in which a total of 6,423 households were involved. The outcome of the survey revealed that the number of seafood meals for households at Tongatapu averaged 2.6 per week, while the average seafood meals per week for Vava'u and Ha'apai were 2.9 and 3.2, respectively.

- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. For the whole of Tonga, the annual per capita fish consumption (whole weight equivalent) was 20.3 kg.[9] Fresh fish made up 80% of this amount.
- Salcone et al. (2015) examine the FAO Food Balance Sheets spanning the years 2005 to 2011. Fish represented 10.2% of protein in 2005, 13.5% in 2007, 14.3% in 2009, 9.9% in 2010 and 11.5% in 2011. In the period 2007–2011, there was between 30 kg and 35 kg of seafood per capita available in Tonga per annum.

The consumption by Tongans of fish caught by offshore fishing is substantial. In the document "Fisheries Exports" (MOF 2022a), information related to the domestic sales of tuna from the locally based longline fleet is given (Table 17-9).

**Table 17-9:** Disposal of tuna from locally based longliners (t)

| | Total tuna unloading | Total tuna export | Remaining tuna after export |
|---|---|---|---|
| 2011 | 322.26 | 91 | 231.26 |
| 2012 | 1,079.12 | 572 | 507.12 |
| 2013 | 2,215.40 | 306 | 1,909.40 |
| 2014 | 1,275.02 | 343 | 932.02 |
| 2015 | 4,111.48 | 1,018 | 3,093.48 |
| 2016 | 5,520.81 | 1,956 | 3,564.81 |
| 2017 | 4,552.63 | 2,105 | 2,447.63 |
| 2018 | 1,449.80 | 632 | 817.8 |
| 2019 | 3,237.19 | 2,217 | 1,020.19 |
| 2020 | 1,559.24 | 906 | 653.24 |

Source: MOF (2022a)

The table suggests that in some years, up to 3,500 t of tuna from the local longline fleet is available in Tonga. If 1,000 t of tuna is sold annually in Tongatapu, that equates to about 13 kg per year for each of the 75,000 residents of Tongatapu.

The Ministry of Fisheries has an initiative geared to increasing the consumption of tuna. As reported by the 2020/21 Ministry Fisheries Annual report, the

[9] Section 17.1 above contains some reservations about the accuracy of the Tonga HIES for estimating fisheries production.

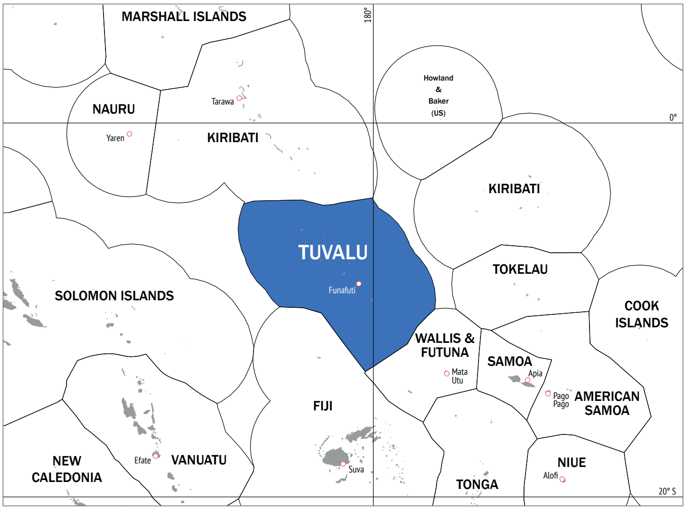
NCD project was started in 2016 and aimed at combating NCDs in Tonga with affordable tuna at a price range of T$7 to T$9 per kilogram. The project operates under a memorandum of agreement between the Ministry of Fisheries and the authorised agent for foreign vessels fishing, Ngatai Marine Enterprises. In the agreement, foreign fishing vessels are required to offload 3.5 t of tuna for the project in high peak seasons and 2.5 t in low peak seasons. As part of the project for FY 2021/22, a total of 152 t of tuna was sold locally in Tongatapu and Éua.

## 17.7 Exchange rates

The average yearly exchange rates (Tonga Pa'anga [T$] to US dollar) used in this book are as follows.

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|
| 1.86 | 2.20 | 2.31 | 2.22 | 2.24 | 2.35 | 2.28 | 2.28 | 2.41 |

# 18 Tuvalu




## 18.1 Volumes and values of fish harvests in Tuvalu

### Coastal commercial catches in Tuvalu

The following summarise the major historical attempts to estimate coastal fish catches in Tuvalu in recent years:

Dalzell et al. (1996) used data from the Food and Agriculture Organization (FAO), Pacific Community (SPC) and unpublished sources from the late 1980s and early 1990s to estimate coastal commercial fisheries production of 120 tonnes (t), worth A$97,811 (Australian dollars) and a subsistence catch of 807 t, worth A$657,781.

- SCP (1997) stated: "Little information is available on the landings of fish in Tuvalu. A statistical program was initiated with assistance from SPC in about 1986, but has not been developed. Some surveys have been undertaken on Funafuti, but overall estimates for the country are probably most reliably derived from the 1994 household survey. This indicates consumption in Funafuti on the order of 60.0 kg per capita and on the islands of around 120.0 kg on average, though there is substantial variation between islands. These levels would indicate national landings of the order of 1,000 tonnes of fish." The project that produced the report had a substantial in-country presence in Tuvalu.

- Gillett and Lightfoot (2001) took the SCP estimate, added 100 t for population growth over five years and assumed that 20% of the total catch was commercial. This resulted in an estimate of a coastal commercial catch of 222 t, worth A$440,000, and a coastal subsistence catch of 880 t, worth A$1,443,200.
- The SPC Pacific Regional Oceanic and Coastal Fisheries (PROCFish) fish consumption studies suggest an annual Tuvalu coastal fisheries production of 1,649 t (Sauni et al. 2008).
- Gillett (2009a) considered the above estimates and also took into account the results of the 2004/05 household income and expenditure survey (HIES) (both the published results and fisheries-relevant unpublished data), as well as population growth. It was concluded that in the mid-2000s, annual coastal commercial production in Tuvalu was about 226 t, worth A$733,666 to fishers, and subsistence production was 989 t, worth A$2,656,896 to fishers.
- McClurg and Carnie (2012) assumed a total coastal fisheries production of 1,100 t[1], worth A$4.4 million. They valued the production based on the observation that "fish (reef, lagoon tuna and flying)" were sold for A$4.00/kg in late 2012. Staff of the Fisheries Department assumed this 1,100 t to be reasonably correct and have used it as a working figure.
- Gillett (2016) considered the previous estimates and recent factors that could change the production from coastal fisheries: a change in abundance of fish from recent studies, increased electrification in the outer islands, increased incidence of ciguatera, withdrawal of government support to the community fisheries centres, movement of people from the outer islands to Funafuti, the results of monitoring small-scale pelagic fishing and the results of the 2010 HIES. The study also made several observations relevant to estimating coastal fisheries production: (a) many of the previous estimates were based on a HIES that was carried out 21 years ago, (b) it is likely that one third of the coastal fisheries production in the country is from ocean fishing and two thirds from reef/lagoon fishing, and (c) a feeling that the 2004/05 Tuvalu HIES suggested a coastal production that was too low. Gillett (2016) concluded that the recent annual Tuvalu coastal fisheries production is estimated to be 1,435 t, comprised of a commercial component of 300 t, worth A$912,500 to fishers, and a subsistence component of 1,135 t, worth A1,366,750 to fishers.

[1] The reference does not mention how this coastal fisheries tonnage was derived, but the authors were furnished with the results of the Gillett (2009a) and Gillett and Lightfoot (2001) studies prior to their travel to Tuvalu.

Since the last estimate above, new sources of information on coastal fisheries have become available, and there have been events that conceivably could affect fisheries production.

In recent years, there has been increased emphasis on monitoring coastal fisheries catches. An Inshore Fisheries Adviser (funded by the New Zealand Aid Programme) worked in Tuvalu during the period 2015–2020. One of the activities of the adviser was to help establish and facilitate creel surveys (Box 18-1).

**Box 18-1:** The Tuvalu creel surveys

Creel surveys are the primary method of collecting coastal fisheries data in Tuvalu. Creel data provide important insights on harvests, effort, and fisher perceptions, which ultimately inform management decisions. The surveys are low-cost, easy to implement and provide a rapid assessment of coastal fisheries resources. Tuvalu now has one of the longest-running creel data collection programmes in the Pacific; more than 80,000 fish have been measured in the 3,500+ surveys carried out across the 9 islands since 2015. Data collectors play an important role in continuing this programme, by collecting and monitoring fishers' catch at the landing sites.

The Coastal Fisheries Creel Report Card summarises the results of monitoring key indicators during creel surveys. The key indicators used to show the health of the resources are: (1) Percentage of fishes that are landed which are smaller than the size at which at least 50% of the fish can breed and (2) Catch of fishes per unit of effort.

In terms of results, overall, there has been little improvement in the health of the coastal fisheries over the past 5 years since surveys were begun. Some improvements in sizes of fishes being landed took place between 2015 and 2018 but were reversed by 2019. Management plans need to be improved and/or implemented more strongly to improve the health of Tuvalu's coastal fisheries.

Source: Coastal Fisheries Creel Report Card (TFD 2020); Fisheries Department Annual Report 2021 (TFD 2022b)

According to the Inshore Fisheries Adviser, the creel surveys have not yet been used to estimate fisheries production (U. Kaly, per. com. September 2022). This situation (i.e. lack of expansion of the survey results to approximate total catches) is similar to that of the relatively new programmes of coastal fisheries monitoring in other Pacific Island countries.

There was a mini census in Tuvalu in 2017. The report of the census (CSD 2018c) and an agriculture and fisheries report based on the census (CSD 2021b) contain information relevant to estimating coastal fisheries production, including these observations and facts:

- Tuvalu is highly dependent on coastal fishery resources to meet domestic needs and safeguard food security. Evidence suggests that coastal marine

life is being impacted by pollution, overfishing and coastal degradation, particularly around Funafuti. Septic tank leakage and uncontrolled liquid sanitation waste has created harmful and excessive nutrient loads in the Funafuti lagoon and is likely the cause of *Sargassum* seaweed overgrowth and chronic problems with ciguatera that began some time before 2010.
- Between 2012 and 2017, the population of Funafuti (where commercial fishing is more common) increased by 16.3%, and that of the outer islands (where subsistence fishing is more common) decreased by 19.5%.

A Tuvalu HIES in 2015/16 (SPC and CSD 2018) found that in terms of value, 36% of fish and seafood is cash purchased and 64% is home produced. The Fisheries Technical Advisor to the Tuvalu Fisheries Department (M. Batty, per. com. February 2023) commented on coastal fisheries production:

> I think [coastal fisheries production] is falling, but perhaps not quite as much as the HIES figures suggest. From my observation there is less fishing in Funafuti than there used to be, and a lot of imported frozen chicken. However, the HIES uses only a sample of islands for the outer island production and the latest one did not include any of the lagoon islands which tend to have more fish - so it may also be an underestimate. Our inshore fisheries adviser looked at the proportion of tuna vs. reef fish in the catch and came up with a figure of 59% tuna – which seems about right.

In the period since the Gillett (2016) estimate of coastal fisheries production, the most significant event affecting coastal fisheries in the country was Covid. A survey of Covid impacts on fishing and coastal communities (LMMA and TFD 2020) reported the major impacts:

> COVID-19 government restrictions appear to have affected the majority of respondents through disrupted shipping services reducing canteen stocks and fuel availability, and an increasing population from residents returning from Funafuti. There was an overall average increase in population of 28% observed in three islands, outward migration was observed from one island, Nukufetau. Food availability issues were reported by a majority; a third stated there was enough local food, with a shortage only in imported foods. Increased prices of tinned fish was reported by 85% of respondents and increased prices of rice by 70%. Farming and fishing activities were noticed to increase as reported by half the respondents, whilst offshore fishing activities have decreased due to low fuel availability as reported by about half of the respondents.

A former Tuvalu Inshore Fisheries Adviser, with experience in Tuvalu spanning several decades, observed that many of the recent estimates of total coastal fisheries production have converged around 1,500 t per year.

Discussions on fish prices were held with the Technical Adviser to the Tuvalu Fisheries Department and with a local consultant hired for the present study. This led to the decision to use the following prices: A$5 for sales on Funafuti and A$3 for sales on the outer islands (M. Batty and S. Maheu, per. com. December 2022).

The information in this section is inadequate for making a good estimate of the coastal fisheries production in Tuvalu in 2021. Nevertheless, a crude approximation is 1,500 t, comprised of a commercial component of 350 t, worth A$1,575,000 to fishers, and a subsistence component of 1,150 t, worth A$2,817,500 to fishers.

### Coastal subsistence catches

Following from the above discussion, the annual coastal subsistence fisheries production in Tuvalu in 2021 is estimated to be 1,150 t, worth A$2,817,500 to fishers.

### Locally based offshore catches

Although there were seven Tuvalu-flagged offshore fishing vessels in 2021 (six purse seiners, one longliner), none of those were based in Tuvalu (M. Batty, per. com. February 2023). There was no offshore catch made by locally based vessels in 2021.

### Foreign-based offshore catches

The Tuvalu report to the Scientific Committee of the Western and Central Pacific Fisheries Commission (TFD 2022a) states that the Tuvalu Fisheries Department issued a total of 183 fishing licenses in 2021 under the category of bilateral agreements, which is 21 fewer than the previous year and 56 fewer than the high point reached in 2019. The purse seiners made up 59% of this, followed by longliners and reefer carriers at 14% each, and pole and line and bunkers at 6% each (Table 18-1).

**Table 18-1:** Number of bilateral licenses issued for fishing in Tuvalu waters

| Year | Longline | Purse seine | Pole & line | Fish carrier | Bunker | Total |
|---|---|---|---|---|---|---|
| 2017 | 115 | 82 | 0 | 40 | 0 | **474** |
| 2018 | 77 | 93 | 0 | 45 | 0 | **215** |
| 2019 | 70 | 104 | 14 | 51 | 0 | **239** |
| 2020 | 31 | 98 | 16 | 55 | 4 | **204** |
| 2021 | 27 | 108 | 12 | 26 | 10 | **183** |

Source: TFD (2022a)

In Tuvalu's exclusive economic zone (EEZ) in 2021, vessels operating under bilateral agreements with countries (Korea, Taiwan and Kiribati) as well as multilateral agreements including the U.S. Treaty and FSM Arrangement made the majority of the tuna catch. In Tuvalu's EEZ, fishing vessels brought in a total of 71,817 t of tuna for 2021. This amount included purse seiner total catches of 70,906 t (98.7%), longline catches of 710 t (1%) and pole line catches of 200 t (0.3%) (TFD 2022b).

The value of the 2021 catch of 71,817 t by foreign-based vessels in the Tuvalu EEZ can be obtained by using price information from the Forum Fisheries Agency (FFA 2022b) and adjusting for in-zone prices (FFA gives delivered prices) and bycatch.

The value of the 2021 catch of 71,817 t by foreign-based purse seine, longline and pole/line vessels in the Tuvalu EEZ is estimated to be A$124,671,781.

## Freshwater catches

Tilapia is sometimes considered a freshwater fish because it is found in fresh and brackish water. The results of a survey carried out for climate change adaptation (NAPA 2013a) contain some information about tilapia in Tuvalu. The report states that tilapia appear to be absent from Nui, Nukufetau and Nukulaelae. Tilapia appear to be eaten on Nanumaga, Niutao and Vaitupu, although on most islands they are mainly used for feeding poultry and pigs.

In the absence of other information on tilapia, for the purposes of the present study, the production of tilapia in 2021 will be taken as 2 t, worth A$2,000.

## Aquaculture harvests

According to the Technical Adviser to the Tuvalu Fisheries Department, there has been zero aquaculture production in Tuvalu for at least the last 5 years (M. Batty, per. com. January 2023).

The 2021 annual report of the Tuvalu Fisheries Department (TFD 2022a) states:

> The plans for mariculture hatchery to be built opposite the TFD office at the Teone site have slowly progressed. The designs have been completed and all building materials are on site. However, construction has been postponed due to other projects taking priority. TFD will look again at work on the hatchery in 2022. Most communities have expressed little interest in mariculture activities, although it has enormous potential to support food security and better livelihoods. Some islands, though, have requested for assistance in mariculture/aquaculture.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values[2] of the fishery and aquaculture harvest in 2021 can be made (Table 18-2).

**Table 18-2:** Annual fisheries and aquaculture harvest in Tuvalu in 2021

| Harvest sector | Volume (t) | Value (A$) |
|---|---:|---:|
| Coastal commercial | 350 | 1,575,000 |
| Coastal subsistence | 1,150 | 2,817,500 |
| Offshore locally based | 0 | 0 |
| Offshore foreign-based | 71,817 | 124,671,781 |
| Freshwater | 2 | 2,000 |
| Aquaculture | 0 | 0 |
| **Total** | **73,319** | **129,066,281** |

[2] The values in the table are dockside/farm gate prices, except in the case of offshore foreign-based fishing, where the value in local waters (overseas market prices less imputed transshipment costs) is given.

Figures 18-1 and 18-2 show the volumes and values of Tuvalu fisheries production in 2021.

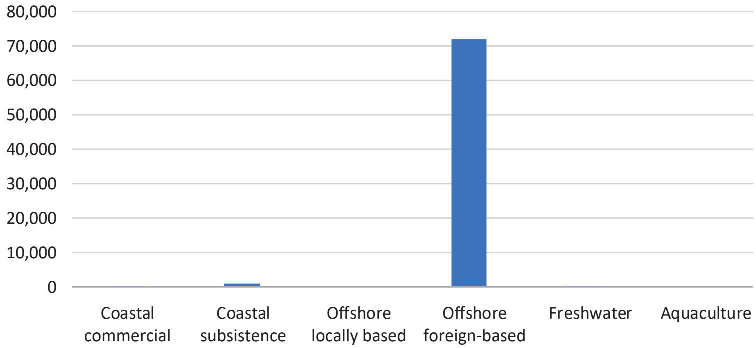



**Figure 18-1:** Tuvalu fisheries production in 2021 by volume (t)

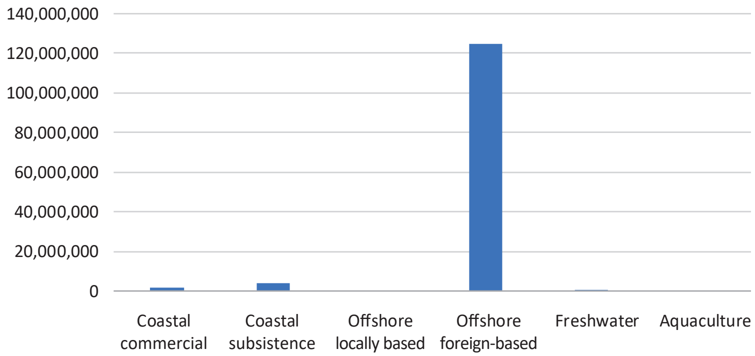



**Figure 18-2:** Tuvalu fisheries production in 2021 by value (A$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for Tuvalu from those four studies are provided in Table 18-3.[3]

[3] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 18-3: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t) | Nominal value (A$) |
|---|---|---|---|
| Coastal commercial | 1999 | 220 | 440,000 |
| | 2007 | 226 | 733,666 |
| | 2014 | 300 | 912,500 |
| | 2021 | 350 | 1,575,000 |
| Coastal subsistence | 1999 | 880 | 1,443,200 |
| | 2007 | 989 | 2,656,896 |
| | 2014 | 1,135 | 1,366,750 |
| | 2021 | 1,150 | 2,817,500 |
| Offshore locally based | 1999 | 0 | 0 |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Offshore foreign-based | 1999 | 40,532 | 58,900,000 |
| | 2007 | 35,541 | 48,700,000 |
| | 2014 | 96,898 | 160,981,136 |
| | 2021 | 71,817 | 124,671,781 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 2 | 2,000 |
| | 2021 | 2 | 2,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0.5 | 1,000 |
| | 2021 | 0 | 0 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production is measured (hopefully, an improvement). In the table above the production levels for coastal commercial, coastal subsistence and freshwater change significantly between the years, but some of that change is due to the way in which the production was estimated. For example, for the 2014 estimate of coastal fisheries production, the results of the 2010 HIES were available. In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 18.2 Contribution of fishing to GDP

### Current official contribution

According to staff of the Central Statistics Division (L. Peleti, per. com. January 2023), the most recent estimation of Tuvalu's GDP was carried out for 2019 (Table 18-4).

**Table 18-4:** The fishing contribution to Tuvalu's GDP (A$ thousands)

| | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| Fishing contribution to GDP | 2,859 | 2,985 | 3,113 | 2,667 |
| Tuvalu GDP | 55,549 | 59,075 | 64,388 | 77,938 |
| Fishing contribution as a % of GDP | 5.1% | 5.1% | 4.8% | 3.4% |

Source: Tuvalu Statistics Division (unpublished data)

### Method used to calculate the official fishing contribution to GDP

According to staff of the Central Statistics Division (L. Peleti, per. com. January 2023) the calculation of fisheries production is based on data collected from the 2015/16 HIES. The value for the target year, 2021, is estimated by multiplying the production value for the base year (2016) by the ratio of the number of households and the consumer price index. It is then added to the production estimated from the Tuvalu National Provident Fund data.

### Alternative estimate of fishing contribution to GDP

Table 18-5 (below) represents an alternative to the official method of estimating fishing contribution to GDP in Tuvalu. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 18.1 above (summarised in Table 18-2) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

Although information on fisheries production is available up until 2021 (Table 18-2), the latest year for which the Tuvalu GDP is available is 2019.

The website of the SPC Statistics for Development Division has a preliminary estimate of the Tuvalu GDP for 2021 of A$72,263,000.

It is not intended that the approach in Table 18-5 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

Table 18-5: Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production ($A, from Table 18-2) | VAR | Value added (A$) |
|---|---|---|---|
| Coastal commercial | 1,575,000 | 0.70 | 1,102,500 |
| Coastal subsistence | 2,817,500 | 0.85 | 2,394,875 |
| Offshore locally based | 0 | --- | 0 |
| Freshwater | 2,000 | 0.92 | 1,840 |
| Aquaculture | 0 | --- | 0 |
| **Total (A$)** | **4,394,500** | --- | **3,499,215** |

The 2021 fishing contribution to GDP from the table above represents about 4.8% of the SPC-estimated GDP of A$72.3 million in 2021.

The fishing contribution for 2021 estimated by the alternative approach is much larger than the official fishing contribution for 2019. The coastal fisheries production values of the two estimates are obviously responsible for the difference. The only comment to be made is that the official coastal fisheries production value was estimated by extrapolating information in the 2015/16 HIES, whereas the alternative approach used a variety of information sources.

## 18.3 Exports of fishery production

The official export statistics of Tuvalu do not have a separate classification for fish, but rather the aggregated category of "Live animals, animal products". In 2021 there were zero exports in that category.

There is information on informal fishery exports in Gillett (2016). This consisted of shell necklaces for passengers on departing flights and the informal export of fish as passenger baggage on departing flights. Due to the reduced number of flights during 2021 because of Covid, the value of those informal fishery exports is likely to have been quite small.

## 18.4 Government revenue from fisheries

### Access fees for offshore fishing

The 2021 annual report of the Tuvalu Fisheries Department (TFD 2022b) contains a statement that clarifies the access fees for offshore fishing: "The department managed to collect a combined revenue of US$32,296,851.10. The selling of fishing days was the biggest contributor accounting for 89% of the total revenue, fishing licenses 9% and transshipment the least with 2%."

It is assumed that "selling of fishing days" plus "fishing licenses" above equates to "access fees for offshore fishing" of the present study. Accordingly, the Tuvalu government revenue for offshore fishing in 2021 was US$31,650,914 (A$43,678,261).

The total revenue (taxation, investments, government charges) for the Tuvalu government for 2021 is estimated to be A$57,230,440 (TANGO 2022). The "access fees for offshore fishing" therefore equate to 76.3% of Tuvalu government revenue for the year.

### Other government revenue from fisheries

One of the major sources of non-access revenue from the fisheries sector is tuna transshipment. Table 18-6 provides transshipment details for seven years. The transshipment levy was US$10.00 per tonne, but after Covid, it was reduced to $7.00 per tonne.

**Table 18-6:** Transshipment statistics

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|
| Transshipment events | 181 | 134 | 163 | 192 | 131 | 148 | 69 |
| Total catch transshipped (t) | 159,377 | 119,628 | 148,555 | 174,345 | 125,335 | 127,089 | 62,799 |
| Total revenue collected (US$) | 489,630 | 1,239,223 | 1,528,167 | 1,784,231 | 1,268,935 | 1,238,774 | 545,430 |

Source: TFD (2022a)

Other major sources of non-access revenue from the fisheries sector are the new vessel flagging arrangements (US$1.2 million in 2021) and the government's investments in joint venture fishing operations. The amount of revenue from the latter is not readily available.

## 18.5 Fisheries-related employment

The Tuvalu 2015/16 HIES (SPC and CSD 2018) contains information about fisheries-related employment:

- In total, 31.5% of urban households and 72.5% of rural households participate in fishing activities for both cash and subsistence, while 5.1% of urban households and 14% of rural households participate in fishing activities for cash alone.
- Fishing activities provide a total A$295,460 in national household cash income.

The 2021 annual report of the Tuvalu Fisheries Department (TDF 2022) indicates that the number of households that participate in fishing for subsistence and cash has declined in recent years, suggesting a growing dependence on wages and salaries.

The Tuvalu Agriculture and Fisheries Report (CSD 2021b), which is based on the 2017 census, indicates:

- The number of households that sell fish declined by 33.3% between 2012 and 2017.
- In 2017 there were 144 males and 15 females whose main activity was fishing. The average age of the males was 37 years and females 30 years.
- Of those whose main activity was fishing, 111 (77%) reside on Funafuti.
- Whilst Funafuti dominates the job opportunities in the public sector, most agriculture, fishing and handicraft production takes place on the outer islands. There is a growing recognition that traditional skills are being lost as many of the younger generation migrate to Funafuti in search of employment or are reluctant to engage in the traditional subsistence lifestyle. Slowing the migration of population to Funafuti and improving the quality of life and income earning opportunities for those on the outer islands remains a high priority.

The FFA Economic Development Indicators report (Ruaia et al. 2020) provides tuna-related employment data for Tuvalu, which includes harvest, processing and ancillary services sectors, observers and government employees (artisanal sector not included): 2016 (188 people employed), 2017 (124), 2018 (124) and 2019 (125).

## 18.6 Levels of fishery resource consumption

The following summarises some older studies on fish consumption in Tuvalu:

- SCP (1997) stated that annual consumption in Funafuti was in the order of 60.0 kg per capita, and on the outer islands it was, on average, around 120.0 kg per capita, although there was substantial variation between islands.
- Preston (2000), using 1995 FAO production, import and export statistics, indicated an apparent per capita fish supply of 85.0 kg per capita per year.
- Gillett and Lightfoot (2001) gave the range of credible estimates of per capita consumption of fishery products in Tuvalu according to various studies as 85.0 kg–146.0 kg per year.
- The Ministry of Natural Resources MNR (2008) summarised the results of many studies on the level of consumption of marine resources in Tuvalu. The report states that estimates of per capita fish consumption vary from island to island but were in the range of 100–200 kg per year.
- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. For Tuvalu, the per capita fish consumption (whole weight equivalent) was 68.8 kg per capita per year in urban areas (fresh fish made up 97% of this amount) and 147.4 kg per capita per year in rural areas (99% fresh fish).
- SPC's PROCFish programme carried out work on several islands in Tuvalu in 2004 and 2005. The report of the survey (Sauni et al. 2008) suggests that the methodology used to estimate fishery product consumption is likely to be more rigorous than that used in the surveys listed above. The study assumed that invertebrate consumption was 5 kg/capita/year on all islands in Tuvalu. The annual fish (canned and fresh/frozen) consumption results were: Funafuti 135.0 kg plus invertebrates, Nukufetau 185.3 kg plus invertebrates, Vaitupu 162.5 kg plus invertebrates, and Niutao 117.8 kg plus invertebrates (Sauni et al. 2008).

In more recent years, the 2021 annual report of the Tuvalu Fisheries Department (TFD 2022b), citing the 2015/16 HIES, states: "Fish consumption was estimated at 72 kg/person/year (90 kg in the outer islands and 55 kg for Funafuti). Although this is still one of the highest consumption rates in the world, it also shows a decline over the past decade."

The 2015/16 HIES gives information the percentage expenditure on food and non-alcoholic beverages. It shows that for all of Tuvalu, expenditure on meat is greater than on fish/seafood – and in rural areas it is about the same (Table 18-7).

**Table 18-7:** Expenditure on common food items (%)

| | Urban | Rural | Total |
|---|---|---|---|
| Bread and cereals | 22 | 15 | **18** |
| Meat | 34 | 21 | **27** |
| Fish and seafood | 12 | 22 | **17** |
| Milk, cheese and eggs | 6 | 4 | **5** |
| Oils and fat | 3 | 2 | **2** |
| Fruit | 2 | 16 | **10** |

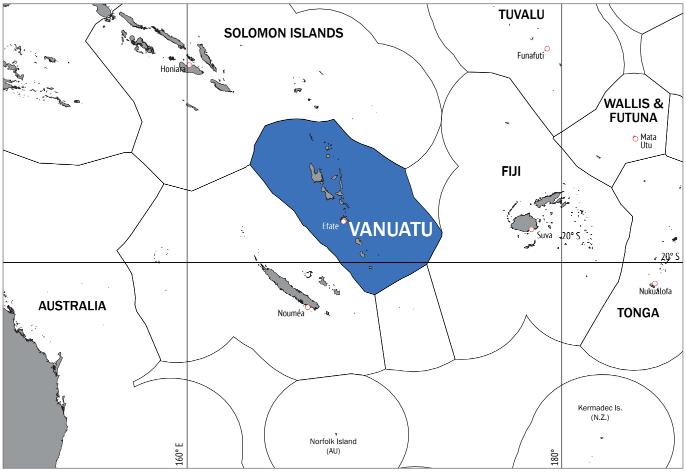
Source: SPC and CSD (2018); Units: % of all expenditure on food

## 18.7 Exchange rates

Tuvalu uses the Australian dollar (A$). The average yearly exchange rates (A$ to the US dollar) used in this book are as follows:

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.96 | 1.12 | 1.22 | 1.37 | 1.37 | 1.29 | 1.42 | 1.44 | 1.32 | 1.38 | 1.53 |

# 19 Vanuatu




## 19.1 Volumes and values of fish harvests in Vanuatu

### Coastal commercial catches in Vanuatu

The following are the major historical attempts to consolidate information on coastal commercial fisheries production in Vanuatu:

Dalzell et al. (1996) used reference material from the late 1980s and early 1990s and estimated that production from the commercial fisheries was 467 tonnes (t), worth US$1,514,364.

- Wright (2000) commented on small-scale commercial fishing. Deep-water snapper fisheries provide 80 t annually to domestic markets, with relatively minor amounts exported. These domestic markets absorb an additional 40 t of shallow water reef fish and coastal pelagics each year. On the basis that coastal fishers receive an average price of VT 400 (Vanuatu vatu) per kg for these fish, the value of these small fisheries to coastal populations throughout the country probably exceeds VT 48 million annually. On the assumption that collectors of trochus receive an average of VT 250 per kg for the raw shell, and that an average of 100 t of shell was harvested annually in each of the last 14 years, coastal communities have received an injection of approximately VT 25 million annually from the trochus fishery alone. It is estimated that other smaller fisheries – principally beche-de-mer, and to a lesser extent aquarium, green snail and crustacean fisheries – contribute at least an additional VT 15 million to local economies annually.

- Gillett and Lightfoot (2001) considered the above studies and ventured an estimate for coastal commercial fisheries production of 230 t, worth VT 88 million annually.
- Gillett (2009a) considered the above studies, plus some additional information: (a) the results of the 2006 household income and expenditure survey (HIES), (b) recent export data, (c) estimates of production from specialised studies, (d) the results of the 2006/07 agriculture census, and (e) opinions of fisheries specialists. The findings indicated: (1) HIES results show that 336 t of local fisheries products (worth VT 75.4 million) were purchased in 2006 for domestic consumption; (2) deepwater and pelagic fish catches of 150 t (worth VT 60 million) should be added to the domestic consumption of the HIES; and (3) Fisheries Department documentation indicates that in recent years there have been exports of fishery product of 52 t and 152,000 pieces (worth VT 91 million). This equates to a coastal commercial fisheries production of 538 t plus 152,000 pieces, worth VT 226.4 million.

For the 2016 Benefish study (Gillett 2016), the results of work by the International Union for Conservation of Nature (IUCN) carried out under the Marine and Coastal Biodiversity in Pacific Island Countries (MACBIO) programme (Pascal et al. 2015) were closely examined. MACBIO used the Vanuatu 2010 HIES as a main source of information. The survey was complemented with information on per capita fish consumption, reports from the Fisheries Department and specialised fisheries work. Gillett (2016) adjusted the MACBIO results with the results of some recent survey reports and information from the Vanuatu Fisheries department to give the following:

- Coastal commercial fisheries production: finfish/crustaceans, 1,000 t (worth VT 450 million to fishers); trochus, 50 t (VT 12.5 million); beche-de-mer, 1.7 t (VT 6 million); aquarium products (VT 65 million) and game fishing, 55 t (VT 39 million). The total 2014 estimated coastal commercial production in Vanuatu is therefore 1,107 t, worth VT 572.5 million to fishers.
- The volumes of the production of subsistence fishing given by the MACBIO study (2,800 t) were accepted as being accurate by Gillett (2016). Valuing that production by the farm gate method (instead of the protein equivalent method used by MACBIO) results in a total value of VT 761.6 million.

Since 2014 (the focus year for the Gillett [2016] study), there have been changes in Vanuatu that affect the estimation of coastal fisheries production. The Fisheries Department commenced issuing an annual "Catch Production and Market Data Report" that gives coastal and offshore production data and information on prices, exports and trends. The report for 2020 (VFD 2021) is 95 pages in length and provides detailed information, but a weakness is that it covers only about 40% of the actual production, with the coverage varying by province – and no attempt is made to extrapolate the reported information to give total production.

Another recent change in Vanuatu coastal fisheries is given in an article on managing Vanuatu's coastal fisheries (Raubani 2019):

> Increased human pressure will also have a significant effect. In 1999, Vanuatu's population was 186,678; a decade later it had risen to 234,023 (2009). Today, the population stands at around 270,000, with two-thirds of the people living within 1 km of the coast and depending substantially on coastal fisheries as a source of food and livelihood. While the population continues to grow, the reef area remains the same at 408 km$^2$; the pressure on marine resources will, therefore, intensify as the population grows.

This suggests that many of the coastal fishery resources, especially those close to places where the population is increasing, are becoming overexploited.

Other information that may be relevant to estimating coastal fisheries production in 2021 is:

- A 2018 study at 11 locations in Vanuatu (Albert et al. 2018) shows the disposal of the catch: 11% of fish were eaten, 4% given away, 20% sold at community markets, 15% at provincial markets and 49% at an urban market. However, the volume of subsistence production compared to commercial production for all of Vanuatu has been estimated to be about three-to-one (S. Gereva, per. com. September 2022).
- The fishery for aquarium products in Vanuatu was substantial (exports of 53 million vatu in 2017), but the last export shipment occurred in 2017 (Gillett et al. 2020).
- Average "market prices" paid for all coastal commercial fishery products was 928 vatu/kg in 2021 (VFD 2021), suggesting that the price paid to fishers could be about 600 vatu/kg.
- In total, 9,858 kg of sea cucumber was reported to have been exported in 2020, with a declared export value of 3,241 vatu/kg (VFD 2021).
- According to the staff of the Vanuatu Fisheries Department (S. Gereva and A. Sokach, per. com. September 2022), Covid caused an increase in coastal subsistence fishing and to a lesser degree, coastal commercial fishing. Much of this increase was because rural residents working in

> the tourism industry lost their jobs when the borders closed, and they returned to their home villages where the quickest/easiest way for them to get food/money was coastal fishing. Another impact was that many community-based reserves were opened during Covid.

The above information is totally insufficient for estimating the country's coastal fisheries production in 2021. Taking the Gillett (2016) estimate and selectively using the available information to modify it for 2021 results in an educated guess of a coastal commercial production of 1,300 t, worth VT 780 million, and a coastal subsistence production of 3,100 t, worth VT 1,085 million.

### Coastal subsistence catches

Gillett (2009a) commented on earlier attempts to estimate coastal fisheries production in Vanuatu:

> In a report for FAO, Preston (1996b) estimates subsistence fisheries production in Vanuatu of 2,000 mt. This appears to have become institutionalized (F. Hickey, personal comm., September 2008) and is quoted in documents, (e.g. the 2007 annual report of the Fisheries Department). The Preston study credited the estimate to Dalzell et al. (1996) which was based largely on an agriculture survey in 1984. A 2008 Vanuatu trade study (Gay 2008) places a value on subsistence production (US$1,953,360) which is precisely that given by Dalzell et al. (1996). The reality is that no original field research focused on estimating subsistence fisheries production in Vanuatu has been carried out in almost a quarter century. [or in 2022, 38 years]

As mentioned above, an educated guess of Vanuatu's coastal subsistence production in 2021 is 3,100 t, worth VT 1,085 million.

### Locally based offshore catches

The paper delivered by the Vanuatu delegation to the 2022 meeting of the Western and Central Pacific Fisheries Commission (WCPFC) Scientific Committee (VFD 2022) indicates that Vanuatu currently operates a vessel registry, the Vanuatu International Shipping Registry (VISR). VISR currently has a total of 94 vessels, of which three are inactive and 91 are active. These consist of 78 longlines, six purse seines, four squid jiggers, two carriers and one bunker. None of these vessels are based in Vanuatu, and few are ever in Vanuatu – none has since at least 2019.

From the readily available information, it is difficult to determine the catches of locally based offshore vessels. The SinoVan company (Box 19-1) is a joint venture with the Vanuatu government that has locally based China-flagged longline fishing vessels.

**Box 19-1:** The SinoVan Company

SinoVan is a joint venture that is 51% owned by the China National Fisheries Corporation and 49% by the Government of Vanuatu. SinoVan operates about 40 vessels, mostly based in Fiji. As part of its tuna fishery domestication policy, VanGov has required SinoVan to start basing its vessels in Vanuatu and landing catches here. Six vessels were doing this in 2020, with others to follow in coming years.

The reason that SinoVan has resisted transferring its operations to Vanuatu is because Fiji has lower operating costs, more regular shipping and airfreight, and better maintenance, provisioning and other services. Operating from Vanuatu is more difficult and costly and makes SinoVan less profitable.

The report to the Scientific Committee states that the SinoVan vessels fished in the Vanuatu zone in 2021 and offloaded their catch in Port Vila. No information is available on the 2021 offloadings (other than the report stating there was 100% offloading of catch in Vanuatu), but in 2020 those vessels offloaded 1,003 t of fish (819 t exported and 184 t sold locally). In 2020 and 2021, with air freight curtailed by Covid, most (if not all) exports by locally based offshore vessels were containerised whole frozen fish sent to China for loining and then to San Diego for canning (G. Preston, per. com. January 2023).

In the absence of information on the 2021 catches of the six locally based offshore vessels, those catches will be taken to be the same as in 2020: 1,000 t of tuna and bycatch. Using prices from the Forum Fisheries Agency (FFA 2022b) and adjusting those destination market prices to be in-zone prices, the catch would be worth VT 256 million.

## Foreign-based offshore catches

The foreign-based offshore catch in the Vanuatu zone is assumed to be the total offshore catch in the zone minus the locally based offshore catch in the zone (as above).

Estimates of the volumes and values of catches of the four main commercial species of tuna in the WCPFC area for the years 1997–2021 have been made by FFA (2022b) using data sourced from the Oceanic Fisheries Programme of the Pacific Community (SPC). The FFA data show that the total tuna catch in the Vanuatu zone in 2021 was 3,320 t, with a destination market value of US$14 million (VT 1,582 million). Adjusting that value to be an in-zone value equates to US$11.2 million (VT 1,265 million). To obtain the value of the catch of foreign-based vessels, the catch of the locally based fleet (from the section above; 1,000 t, worth VT 256 million) must be subtracted, giving 2,320 t, worth VT 1,009 million.

## Freshwater catches

The Vanuatu Fishery Resource Profiles (Amos 2007) contain extensive information on the country's freshwater fish and invertebrate resources. It is reported that the distribution of the various freshwater ecosystems is patchy throughout the Vanuatu archipelago, covering only 1.0% of the total land area of approximately 14,763 km$^2$. Freshwater ecosystems on Vanuatu's larger islands (e.g. the Jordan River on Santo, Cooks River on Erromango Island and Pankumo River on Malekula Island) have discharges which form cascades, rockfaces, pools and tidal reaches and are often characterised as having extensive flood plains. Smaller island ecosystems, on the other hand, only have streams, which are often ephemeral.

The profiles cover 18 families of local freshwater fish, three families of introduced fish and several species of shrimps and crabs. According to the profiles, the most important taxa for fishery purposes are:

- Local species of fish: five genera of fish (*Khulia, Lutjanus, Gerres, Monodactylus* and *Scatophagus*), four species of mullets and several species of freshwater eels.
- Introduced species of fish: *Cyprinus* and two species of tilapia.
- Invertebrates: several species of *Macrobrachium*.

An individual with long historical involvement in Vanuatu fisheries examined the available freshwater fisheries data and discussed the issue of freshwater fishing with other local fisheries specialists. He estimated that recent annual production from freshwater fisheries in the country is about 88 t per year (F. Hickey, per. com. August 2015). The Director of the Vanuatu Fisheries Department indicates that this situation has not changed much for 2021.

The price for subsistence fish, VT 350/kg (determined in the subsistence section above), can be applied to over 95% of the freshwater production. *Macrobrachium* is currently sold by fishers in Port Vila for VT 900/kg. The recent annual production from freshwater fishing of 88 t is estimated to be worth VT 33.3 million.

## Aquaculture harvests

In an article in a 2018 SPC Fisheries Newsletter (Gereva 2018), the then Deputy Director of Coastal Fisheries stated:

> There are seven freshwater and marine commodities cultured in Vanuatu for the purposes of food security, sustainable livelihood, wild stock enhancement and resource management programmes, and entrepreneurial activities. The commodities include introduced freshwater prawn species (Macrobrachium rosenbergii), GIFT tilapia (Oreochromis niloticus), red tilapia (Oreochromis sp.), giant clams (Tridacna spp.), green snail (Turbo marmoratus), trochus (Tectus niloticus), and marine shrimp (Litopenaeus stylirostri). Apart from marine shrimp culture by a large-scale operator, all aquaculture activities are operated at a small-scale, community-based level. This is being promoted and supported by the Vanuatu Fisheries Department as an alternative food source, which helps support coastal resource management by decreasing fishing pressure on nearshore reefs. ……. In Vanuatu, about 1,627 households and 200 farms are engaged in freshwater aquaculture, either for subsistence or semi-commercial purposes. The combined total annual production from these activities is estimated to be 10 tonnes, with an estimated value of VUV 6.2 million (US$56,000).

A 2022 review of aquaculture (IAS 2022) commented on aquaculture in Vanuatu:

- Current species cultivated commercially: Sea cucumber (*H. scabra*). Private hatchery on Aore Island in Sanma Province. Seed moved to Havannah Harbour in Efate and some released locally. No harvest yet, so cannot be judged to be fully commercial. Major problems with ownership of end product. Gets feed for larvae in from Netherlands.
- Current species used for food security & small scale community based production: Tilapia. Using GIFT tilapia from Fiji in Santo and Efate. Now been put on Tanna, Erromango, Ambae. Pentecost, Vanua Lava. Backyard ponds. Ponds at the Tagabe Agric centre in Efate and in Santo for seed production etc. Feed provided by government, so doubts over sustainability. Teoma Farms on Efate are producing shrimp for the local market but reduced production due to Covid. Overall production given as 6 tonnes in 2018 by World Bank.

- Other species attempted or planned: Trochus, green snail for reseeding of reefs. Mangrove oysters, *M. rosenbergii* prawn, *M. lar* prawn, giant clam. Seaweed (communities didn't like the low returns). Shrimp (*Litopenaeus stylirostris).* Coral culture for aquarium trade.

A regional review of aquarium products in 2020 (Gillett et al. 2020) gives information on coral culture in Vanuatu. In 2008 two aquarium companies commenced small-scale coral farming (VFD 2008). Shocks to the Vanuatu aquarium trade included: (a) the global economic recession starting in 2008, and (b) the destruction caused by Cyclone Pam in March 2015. The last company in the Vanuatu aquarium trade, Sustainable Reef Suppliers, made its final shipment in the third quarter of 2017.

In the present study, information on aquaculture was obtained through discussion with staff of the Vanuatu Fisheries Department and with aquaculture producers.

It was reported that there are several scales of tilapia farms (*with the 2021 status given in italics*):

- Commercial farms: 1,000 $m^2$ and above, *the one farm stopped production in 2020*
- Semi-commercial farms: 200–1,000 $m^2$, *around 100 such farms*
- Subsistence farms: 50–200 $m^2$, *around 80 such farms*
- Backyard farms: less than 50 $m^2$, *many on Efate Island*

In the "2020 Catch Production and Market Report", it is reported that in 2020 tilapia production was 2.53 t. It also states that in 2020, *Macrobrachium lar* production was 227 kg and *Macrobrachium rosenbergii* was 148 kg. The underreporting of the Market Report mentioned in an above section should be noted when considering this information.

Aquaculture staff of the Vanuatu Fisheries Department (L. Dick and J. Rambay, per. com. September 2022) indicate:

- Tilapia production in 2021 was around 4 tonnes but was greater in 2022 due to more ponds constructed with cyclone relief funds.
- Vt 500/kg is the standard farm gate price for tilapia.
- There was no culturing of *Macrobrachium* due to the loss of broodstock in 2020 due to an electric power outage.

Vate Farm, which has 11 ponds in the Teouma area, is the only producer of shrimp. They have reported an annual production of about 10 t. Exports stopped in 2019 and local sales (4,000 vatu/kg) stopped in 2020.

There is some culturing of giant clams in Santo and north Efate, with about 4,000 juveniles produced annually for re-stocking purposes. There is also experimental culturing of sea cucumber, with no sales yet.

It is difficult to summarise the above heterogenous collection of anecdotal information on Vanuatu aquaculture. What can be stated is that several types of aquaculture dropped out in the last few years, especially during the Covid period. 2021 could easily be considered a low point in the history of Vanuatu aquaculture.

For the purposes of the present study, the aquaculture production of the country in 2021 will be assumed to be 8 t of tilapia and 4,000 juvenile giant clams, with a total farm gate value of VT 5.2 million.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values of the fishery and aquaculture harvests in 2021 can be made (Table 19-1).

**Table 19-1:** Annual fisheries and aquaculture harvest in Vanuatu in 2021

| Harvest sector | Volume (t and pcs, where indicated) | Value (VT) |
|---|---|---|
| Coastal commercial | 1,300 | 780,000,000 |
| Coastal subsistence | 3,100 | 1,085,000,000 |
| Offshore locally based | 1,000 | 256,000,000 |
| Offshore foreign-based | 2,320 | 1,009,000,000 |
| Freshwater | 88 | 33,300,000 |
| Aquaculture | 8 t and 4,000 pcs | 5,200,000 |
| **Total** | **7,816 t and 4,000 pcs** | **3,168,500,000** |

The very weak factual basis for the estimate of the coastal, freshwater and aquaculture is acknowledged.

Figures 19-1 and 19-2 show the volumes and values of Vanuatu fisheries production in 2021. Aquaculture is not shown on the volumes figure due to the use of mixed units (pieces and tonnes).

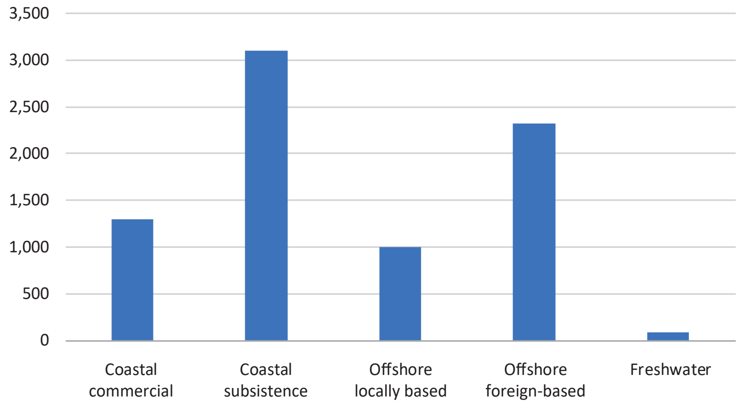



**Figure 19-1:** Vanuatu fisheries production in 2021 by volume (t)

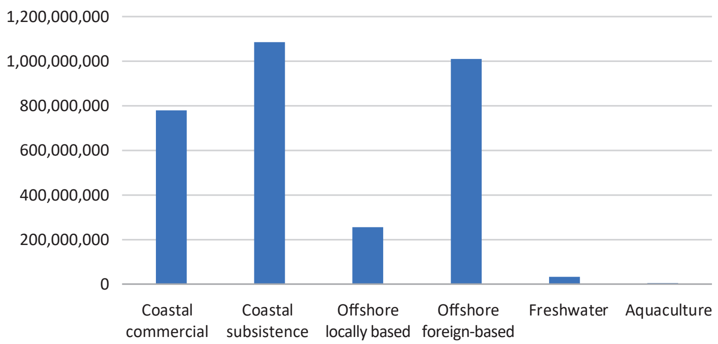



**Figure 19-2:** Vanuatu fisheries and aquaculture production in 2021 by value (VT)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for Vanuatu from those four studies are provided in Table 19-2.[1]

[1] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 19-2: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (VT) |
|---|---|---|---|
| Coastal commercial | 1999 | 230 | 88,000,000 |
| | 2007 | 538 | 226,400,000 |
| | 2014 | 1,106 | 572,500,000 |
| | 2021 | 1,300 | 780,000,000 |
| Coastal subsistence | 1999 | 2,700 | 513,000,000 |
| | 2007 | 2,830 | 597,000,000 |
| | 2014 | 2,800 | 761,600,000 |
| | 2021 | 3,100 | 1,085,000,000 |
| Offshore locally based | 1999 | 0 | 0 |
| | 2007 | 0 | 0 |
| | 2014 | 568 | 151,100,636 |
| | 2021 | 1,000 | 256,000,000 |
| Offshore foreign-based | 1999 | 118 | 32,666,000 |
| | 2007 | 12,858 | 2,704,380,286 |
| | 2014 | 10,942 | 2,706,530,705 |
| | 2021 | 2,320 | 1,009,000,000 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 80 | 18,000,000 |
| | 2014 | 80 | 23,872,000 |
| | 2021 | 88 | 33,300,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 2,500 pcs and 34 t | 31,600,000 |
| | 2014 | 27,300 pcs and 43 t | 39,300,000 |
| | 2021 | 4,000 pcs and 8 t | 5,200,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for the coastal fisheries change significantly between the years, but some of that change is due to the way in which the production was estimated – for example, the 2014 estimate of coastal commercial fisheries production used the MACBIO results. In contrast, changes in production figures in the table for the offshore fisheries (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 19.2 Contribution of fishing to GDP

### Current official contribution

The national accounts are compiled and published by the Vanuatu National Statistics Office (VNSO). VNSO (2022b) gives the nominal and relative contributions of fishing to GDP (Table 19-3).

**Table 19-3:** Fishing contribution to the Vanuatu GDP (current prices)

| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| Fishing contribution (VT millions) | 420 | 438 | 438 | 537 | 546 | 598 | 689 |
| Vanuatu GDP (VT millions) | 74,970 | 79,657 | 84,707 | 94,887 | 100,771 | 107,450 | 104,929 |
| Fishing as a % of GDP | 0.56% | 0.55% | 0.52% | 0.57% | 0.54% | 0.56% | 0.66% |

Source: VNSO (2022b)

### Method used to calculate the official fishing contribution to GDP

Limited information on the methodology used for estimating the fishing contribution to GDP was obtained from VNSO. According to VNSO (2022b), the 2020 GDP estimate is made by the production approach, but VNSO continues to compute and monitor GDP from an expenditure approach, which provides systematic checks. According to VNSO staff, information on the production from coastal commercial and subsistence fisheries was obtained from the 2006 Agriculture Survey, adjusted for changes in population size and amounts of fishery product exports.

In the previous Benefish book (Gillett 2016), it was explained that in estimating the 2014 GDP, VNSO considered commercial fishing as a component of "commercial agriculture", and subsistence fishing as a component of "subsistence custom/traditional agriculture". This practice does not appear to be followed for the 2020 GDP as the words "subsistence" and "custom" do not appear in the GDP release document.

### Alternative estimate of fishing contribution to GDP

Table 19-4 (below) represents an alternative to the official method of estimating fishing contribution to GDP in Vanuatu. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 19.1 above (summarised in Table 19-1) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 19-4 replace the official methodology, but rather that the results obtained serve as comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

**Table 19-4:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (VT, from Table 19-1) | VAR | Value added (VT) |
|---|---|---|---|
| Coastal commercial | 780,000,000 | 0.70 | 546,000,000 |
| Coastal subsistence | 1,085,000,000 | 0.90 | 976,500,000 |
| Offshore locally based | 256,000,000 | 0.20 | 51,200,000 |
| Freshwater | 33,300,000 | 0.90 | 29,970,000 |
| Aquaculture | 5,200,000 | 0.55 | 2,860,000 |
| **Total (VT)** | **2,159,500,000** | -- | **1,606,530,000** |

The fishing contribution to GDP in 2021 from Table 19-4 (VT 1,606,530,000) represents about 1.53% of Vanuatu's 2020 GDP of VT 104,929,000,000. This is more than twice the official estimate of 0.66%.

In Table 19-4 (above) there is a contribution to GDP from offshore locally based fishing. In the present study, all offshore locally based fishing is assumed to be part of the local economy and therefore contribute to GDP, unless there is information that indicates otherwise. If the locally based offshore vessels can be shown to have their centre of economic activity outside Vanuatu, then the value added of those vessels (i.e. 51.2 million vatu in the alternative contribution for 2021, Table 19-4) should be removed from Vanuatu's GDP.

Given the limited amount of information on the methodology used to make the official estimate of the fishing contribution to GDP, the reason why the alternative estimate is so different from the official estimate can only be speculated. Obviously, comparing the 2021 contribution of the alternative estimate to the 2020 contribution of the official estimate could be responsible for some (but certainly not all) of the difference. Above it is stated that according to VNSO staff, information on the production from coastal commercial and subsistence fisheries in the official estimate was obtained from the 2006 Agriculture Survey, adjusted for changes in population size and amounts of fishery product exports. Gillett (2009a) examined the reports of those surveys and concluded:

> Agriculture censuses were carried out in 2006 and 2007. Those surveys had limited coverage of fishing activity, limited to household participation in fishing and frequency of fishing. In the analysis of the data, no new estimates of production from fishing were made.

It is likely that much of the large difference between the alternate estimate of fishing contribution to GDP and official estimate is due to very different assessments of the amounts of production from coastal commercial and coastal subsistence fisheries.

## 19.3 Exports of fishery production

The Merchandise Trade Statistics (VNSO 2022a) give the principal exports of Vanuatu. The fisheries-relevant parts are extracted and given in Table 19-5.

**Table 19-5:** Fishery exports of Vanuatu (million VT)

| | Shells | Live fish | Fish | Total fisheries | Total exports | Fisheries as % of total exports |
|---|---|---|---|---|---|---|
| 2017 | 5 | 53 | 26 | 84 | 5,909 | 1.4% |
| 2018 | 0 | 6 | 0 | 6 | 4,842 | 0.1% |
| 2019 | 16 | 0 | 33 | 49 | 5,231 | 0.9% |
| 2020 | 11 | 0 | 191 | 202 | 4,650 | 4.3% |
| 2021 | 0 | 0 | 199 | 199 | 5,646 | 3.5% |

Source: VNSO (2022a)

Other aspects of the fishery exports of Vanuatu are:

- Gillett et al. (2020) state the aquarium product exports of Vanuatu were 53 million vatu in 2017 – the same as "live fish" in the above table.
- FFA's "Tuna Report Card" (FFA 2022a) gives Vanuatu's average annual tuna exports during the period 2018–2020 to be US$91 million. Table 19-5 (above) gives the "fish" exports during the same three-year period as 224 million vatu or 74.7 million vatu annually (approximately US$644,000 annually). The fact that all fish exports of those three years in the official statistics are much smaller than just the tuna exports for the same period may be due to differences in how much tuna is included in the categories of export, re-export and transshipment.[2]

[2] FFA considers that fish transshipped from a Vanuatu-registered vessel, anywhere in the world, is considered an export of Vanuatu (C. Reid, per. com. March 2023).

## 19.4 Government revenue from fisheries

### Access fees for offshore fishing

Unpublished data from the Vanuatu Fisheries Department indicates that Vanuatu received:

- In 2020, US$1,980,000 as payment for "Foreign fishing license"
- In 2021, US$1,073,000 as payment for "Foreign fishing license"
- In 2020, US$120,000 as payment for "Locally-based foreign fishing license"
- In 2021, US$180,000 as payment for "Locally-based foreign fishing license"

The total amount for 2021 was therefore US$1,253,000 (approximately 141.7 million vatu) for offshore access. As the total "government revenue excluding donors" in 2021 was 9,193 million vatu (VNSO 2022a), payments for foreign fishing equates to 1.5% of all revenue for the year.

### Other government revenue from fisheries

In addition to the above revenue for offshore fishing access, the Vanuatu government receives other revenue from the coastal fisheries and aquaculture sectors. Unpublished data from the Vanuatu Fisheries Department shows the following types of licences:

- International authorization to fish
- Artisanal fishing licence
- Fish export establishment licence
- Sea cucumber processing licence
- Sea cucumber export licence
- Aquaculture license

In 2020 the above licences generated 5,600,000 vatu in revenue. In 2021 the amount was 6,020,000 vatu.

In addition to the above licenses, Vanuatu charges a levy on the export of fishery products – up to 5% is allowed by law. The actual amounts received by the Vanuatu government are not readily available.

Vanuatu's vessel registry, the VISR, currently has a total of 94 fishing vessels, of which three are inactive and 91 are active. These consist of 78 longlines, six purse seines, four squid jiggers, two carriers and one bunker. The revenue from the fishing vessels on the VISR could be considered a form of government revenue from fisheries. The actual amounts received by the Vanuatu government are not readily available.

## 19.5 Fisheries-related employment

In the 2020 National Population and Housing Census (VNSO 2021c), most data relevant to fisheries is aggregated into the category "agricultural, forestry and fishery", reducing its utility for fisheries purposes. It does contain the interesting fact that of the 63,365 households in the country, 39.8% are engaged in fishing, with 10.7% in urban areas and 48.6% in rural areas.

Similarly, in the Labour Market Monograph (VNSO 2021b), most data relevant to fisheries is aggregated into the category "agricultural, forestry and fishery".

The Vanuatu 2019/20 HIES (VNSO 2021a) gives the percentage of total income from fisheries (Table 19-6).

**Table 19-6:** Household income from Fisheries

| | Home production, fisheries | Cash, fisheries |
|---|---|---|
| National | 9% | 6% |
| Rural | 9% | 5% |
| Urban | 7% | 18% |

Source: VNSO (2021a)

The report "Well-Being in Vanuatu 2019–2020" (VNSO 2021d) is an expanded household income and expenditure survey that collected data critical for informing national economic, social and environmental policy. With respect to fishing, the results indicate:

- Just under one third (31%) of households in Vanuatu had members actively engaged in fishing, and 29% of households reported consumption of free fish from home production each week.
- Fishing is most prevalent in Torba Province, where 75% of households have members engaged in fishing activities.
- Nearly three quarters (71%) of the population, predominantly those living in coastal communities, enjoy free access to marine resources including fish, crabs, shellfish and more.
- The survey asked all people aged 15 if they were able to do, make, or perform 16 different skills that demonstrate traditional knowledge and economic self-reliance. A total of 38% responded that they were able to fish with a canoe, and 24% responded that they could fish with a handmade spear.

Data on the gender aspects of fishing in Vanuatu is not plentiful. Readily available information is limited to older references:

- SPC (2013) uses Pacific Regional Oceanic and Coastal Fisheries (PROCFish) project data to examine the ratio of men to women fishers across the Pacific. For the Vanuatu sites examined, about 52% of fishers are men and 48% are women.
- A report on the Millennium Development Goals (Prime Minister's Office 2010) states that a large number of women are engaged in the fisheries sector. Their main activities involve gathering fish and shellfish for home consumption, which is barely identified as "fishing" by the male community. Since "fishing" as an activity is usually identified where selling is involved, and women selling fish is not the norm in Vanuatu, women's activities in the sector remain largely invisible.

The role of Vanuatu fisheries is explained in an article on coastal fisheries and human development in Vanuatu (Hickey 2008):

> Most rural-based women fishers use their catches primarily to ensure household food security. Since no cash is involved, these fisheries are viewed by policy-makers and donors as less important than commercial fisheries. However, women are becoming increasingly involved with commercial fisheries, including for trochus, as well as in adding value to their catches. Many women with access to markets in Vanuatu, collect fish, octopus and shellfish, including giant clams, for preparation with traditional puddings covered in coconut cream to produce a value-added product for sale in municipal markets or other popular outlets, such as kava bars. Alternatively, some women in the urban areas simply purchase reef fish from urban outlets for preparation in puddings for sale at various outlets, thereby adding value to these catches.

FFA's Tuna Report Card (FFA 2022a) indicates that over the period 2018–2020, an annual average of 560 people in Vanuatu had tuna-related employment. "Employment" in that study encompasses the harvest, processing and ancillary services sectors, observers and government employees (the artisanal sector is not included).

## 19.6 Levels of fishery resource consumption

Information from the early studies of fishery resource consumption in Vanuatu shows:

- Preston (1996b) estimates annual per capita fish supply from coastal fisheries in Vanuatu of 15.9 kg.
- Preston (2000), using 1995 FAO data and considering production, imports and exports, estimates annual per capita supply of fishery products of 21.0 kg.
- Gillett and Lightfoot (2001) considered Vanuatu fishery production, imports, exports and population and estimated that annual per capita consumption of fishery products in 2000 was about 25.7 kg.
- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. For the whole of Vanuatu, the annual per capita fish consumption (whole weight equivalent) was 20.3 kg, of which 60% was fresh fish. For rural areas, the per capita consumption of fish was 20.6 kg, and for urban areas it was 19.3 kg.

Farmery et al. (2020) describe a study of aquatic foods and nutrition in the Pacific. That study used a variety of types of information, including nutrient composition data from the newly created Pacific Nutrient Database, national level data on aquatic food consumption from household income expenditure surveys, village-level data on women's food consumption, and trade data from the newly developed Pacific Food Trade Database. The mean daily per capita apparent consumption of aquatic foods for Vanuatu for 2010 is shown in Table 19-7.

**Table 19-7:** Mean daily per capita consumption of aquatic foods in Vanuatu

| Aquatic food group | National | Rural | Urban |
|---|---|---|---|
| Pelagic fish | 14.4 (0.63) | 18.0 (0.82) | 4.4 (0.49) |
| Reef fish | 7.2 (0.49) | 7.6 (0.58) | 6.1 (0.88) |
| Canned fish | 14.1 (0.30) | 13.3 (0.30) | 16.3 (0.68) |
| Shellfish | 1.6 (0.08) | 2.0 (0.11) | 0.44 (0.05) |
| Mixed fresh/frozen fish | 1.4 (0.11) | 1.7 (0.14) | 0.58 (0.16) |
| Aquatic food (total) | 38.8 (0.99) | 42.6 (1.23) | 27.9 (1.40) |

Source: Farmery et al. (2020); Units: Edible portion in grams ± standard error

The Vanuatu Food Security Profile (VNSO, FAO and SPC 2021), using information from the 2019/20 National Sustainable Development Plan (NSDP) Baseline survey, comments on fish consumption. It states that in Vanuatu, fish, shellfish and their products contribute about 4% to the average dietary energy consumption. Out of 11 food groups, fish are the least affordable source of dietary energy: "With 100 vatu it is possible to get five times more calories from sugar than from fish".

Albert et al. (2018) describe a study that used fisheries data collected by community monitors between February 2017 and July 2018 from 11 sites across four provinces in Vanuatu. The report states that estimated annual fresh fish consumption ranged from 13 to 37 kg per person (on average 23 kg per person). The lowest consumption rates were at Tangoa and Peskarus, while the highest were at Ikaukau, Lelepa Island and Mangalilu. The average consumption rate of fresh fish for each community was within the range estimated by Bell et al. (2009b).

The 2019/20 HIES (VNSO 2021a) reports on the expenditure on fish and seafood as a percentage of all expenditure on food and non-alcoholic beverages: Vanuatu overall 12%, rural 13% and urban 9%. The comparable percentages for meat are: 12%, 9% and 16%.

In the section above on locally based offshore catches, it is stated that 184 t of fish from longliners was sold locally in Port Vila in 2020. Considering the current population of that urban area (about 55,000) and the scarcity of tourists that year, the local longliner sales provided an average of about 3.3 kg of fish (whole fish equivalent) to each Port Vila resident.

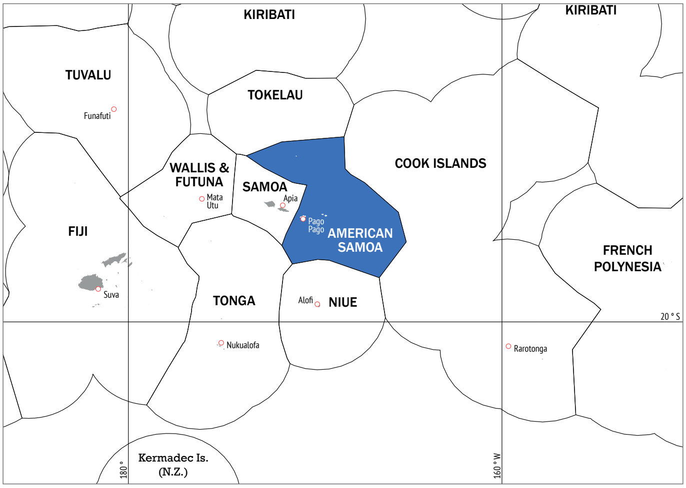
## 19.7 Exchange rates

Vanuatu uses the vatu. The average yearly exchange rates (vatu to the US dollar) used in this book are as follows:

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|
| 102.51 | 109.57 | 110.50 | 105.92 | 113.97 | 116.05 | 109.30 | 113.07 | 122.77 |

# Fishery Benefits in Pacific Island Territories

# 20 American Samoa




## 20.1 Volumes and values of fish harvests in American Samoa

### Coastal commercial catches in American Samoa

The following are the major historical attempts to estimate the production of the coastal commercial fisheries of American Samoa:

- Dalzell et al. (1996) used information from a 1994 statistical report and a 1993 journal article to estimate a mean annual commercial fisheries production in American Samoa of 52 tonnes (t), worth US$178,762.
- Gillett (2009a) estimated that production from the coastal commercial fishery of American Samoa in 2007 (including the pelagic, bottomfish and reef components) was 34.6 t, worth US$166,000 to fishers.
- Gillett (2016) considered the results of various monitoring programmes and factors that would have recently affected coastal fisheries production. It was concluded that a crude estimate for 2014 production would be about 42 t, worth US$244,000 to fishers.

In American Samoa, fisheries are often placed in two categories: (a) shore-based fisheries and (b) boat-based fisheries. The latter category includes trolling, bottomfishing, combined trolling/bottomfishing, spearfishing and longlining.[1] Boat-based fishing in American Samoa is described by Ochavillo (2020) in Box 20-1.

> **Box 20-1:** Boat-based fishing in American Samoa
>
> In 2018, 19 alia boats landed 15,014 kg of pelagic fish through trolling, mix bottom fishing-trolling, and longlining. Yellowfin tuna accounted for 5125 kg, skipjack tuna 3220 kg, albacore 2270 kg, and wahoo 1950 kg. When compared with 2014 pelagic fish landings (18,600 kg), landings have been nearly stable for the last three years, despite the fact that the number of active vessels has declined from 22 in 2015 to 10 in 2018.
>
> Six alia boats landed 6440 kg by bottomfishing in 2018. The major species were longtail snapper with 1,720 kg, gray jobfish 770 kg, silverjaw jobfish 680 kg, ruby snapper 545 kg lbs, humpback snapper 410 kg, and redgill emperor 320 kg. The landings of bottomfish have consistently declined since 2015, when 23,100 kg were landed, and the number of active boats has declined from 21 in 2014 to 6 in 2018.
>
> In 2018, four alia boats landed 14,060 kg of fish caught by free-dive spearfishing. Twenty-two percent of this catch consisted of blue-lined surgeonfish, 10% red-lip parrotfish, 7% bluespine unicornfish, and 6% dark-capped parrotfish. The number of spearfishing boats ranged from three to five boats operating each year since 2014.

In American Samoa there are currently a number of US-funded schemes for monitoring fish catches. The Western Pacific Regional Fisheries Management Council (WPRFMC 2022a) summarises the main ones:

- Boat-Based Creel Survey. The boat-based data collection focuses mostly on the main docks in Fagatogo and Pago Pago. Boat-based data collection is also being conducted in Manu'a. Boat-based data collection in both Ofu-Olosega and Ta'u is opportunistic since there is no set schedule for boats to go out and land their catches.
- Shore-Based Creel Survey. The shore-based data collection follows the same general scheme as the boat-based creel survey and by randomly selecting eight-hour periods and locations four to five times per week to conduct necessary runs. Survey locations are western Tutuila from Vailoa to Amanave, central Tutuila from Aua to Nuuuli, eastern Tutuila from Lauli'i to Tula, while the Manu'a routes are relatively more complicated.
- Commercial Receipt Book System. Entities that sell any seafood products are required by law to report their sales. This is done through a receipt book system collected on the 16th day of every month.

[1] In the present study (which covers the entire region), longlining is considered part of the category "locally based offshore fishing".

- Boat Inventory. An annual boat inventory is being conducted to track down fishing boats and determine their ownership.

In American Samoa (as in the Northern Mariana Islands and Guam), there is no shortage of fishery surveys and associated results – but trying to use that data to estimate total fishery production is not easy. According to staff of National Oceanic and Atmospheric Administration (NOAA) Fisheries in Honolulu, not all geographic areas of American Samoa are covered. As reported by the Director of the Department of Marine and Wildlife Resources (DMWR), there are challenges with both gaps and overlaps of the various catch monitoring programmes (R. Matagi-Tofiga, per. com. September 2015). Another difficulty is that the results of the programmes do not fit neatly into the categories of the present study.

By using the Western Pacific Fisheries Information Network (WPacFIN)[2] data portal of NOAA Fisheries, it is possible to construct Table 20-1 giving the annual catches of the major fisheries in American Samoa.

**Table 20-1:** Catches of the major fisheries in American Samoa

| | Method | Estimated annual pounds | Estimated annual kg |
|---|---|---|---|
| 2019 | Trolling | 17,348.69 | 7,869.23 |
| 2019 | Bottomfishing | 18,425.73 | 8,357.76 |
| 2019 | Mixed troll/bottomfish | 2,773.46 | 1,258.02 |
| 2019 | All others | 41,390.19 | 18,774.26 |
| | **2019 total** | **79,938.07** | **36,259.27** |
| 2020 | Trolling | 7,810.17 | 3,542.63 |
| 2020 | Bottomfishing | 13,635.51 | 6,184.96 |
| 2020 | Mixed troll/bottomfish | 6,812.25 | 3,089.98 |
| 2020 | All others | 27,664.70 | 12,548.49 |
| | **2020 total** | **55,922.63** | **25,366.06** |
| 2021 | Trolling | 21,530.09 | 9,765.88 |
| 2021 | Bottomfishing | 1,189.51 | 539.55 |
| 2021 | Mixed troll/bottomfish | 5,969.74 | 2,707.83 |
| 2021 | All others | 23,773.32 | 10,783.39 |
| | **2021 total** | **52,462.66** | **23,796.64** |

Source: https://apps-pifsc.fisheries.noaa.gov/wpacfin/Catch-and-Effort-Data.php

[2] Established in 1981, the Western Pacific Fisheries Information Network (WPacFIN) is a cooperative programme involving the WPacFIN Central office at the Pacific Islands Fisheries Science Center and participating fisheries agencies in American Samoa, the Commonwealth of the Northern Mariana Islands, Guam and Hawaii. WPacFIN helps its partner agencies consolidate, summarise, and provide access to the available fisheries data to meet the needs of fishery managers, scientists and fishermen.

Following from the table above several points should be noted:

- Information on the WPacFIN website[3] indicates that the "all others" in the table above includes shore-based commercial fishing activity.
- As per the WPacFIN website[4], the "all others" category in the table also includes longlining, which is not in the "coastal commercial" category" of the present study. As the catch of American Samoan longliners in 2021 was 994 t (NMFS 2022), this suggests that the longlining included in the above table is a subset of all longlining in American Samoa. The staff of DMWR stated there were two alia longliners (i.e. 9-metre vessels) operating in 2021 and the Statistics Division (2021) states that 18,836 pounds (8.5 t) were caught by longlining in American Samoa in 2018. Following from this information, it is assumed that the longlining included in the "all others" category for 2021 is for the alia longline fish, about 8.5 t.
- The 2021 fisheries production in the table above could be adjusted (i.e. reduced by 8.5 t) to give a total coastal commercial production of 15.3 t.

Is 15.3 t a reasonable amount for the production of all coastal commercial fishing in American Samoa? This seems quite small compared to the estimate of 42 t for 2014 by Gillett (2016), but the following should be considered:

- Table 20-1 (Catches of the major fisheries in American Samoa) shows a large contraction in recent years in the number of boats participating in the major coastal commercial fisheries of American Samoa.
- Based on information from the head of the American Samoa Statistics Division (M. Filiga, per. com. October 2022), the population of American Samoa has been going down for several years – and this has been accelerated by Covid. The closing of the MacDonald's was cited as a practical implication of the population decline.
- There appears to be a long-term decline in coastal fishing in Samoa. Sabater (2007) reviewed many studies in American Samoa and concluded that coastal fishing effort in American Samoa has decreased over the past two or three decades.
- Fisheries officials in Apia report a recent increase in the export of reef fish to American Samoa.
- Data in the American Samoa Statistical Yearbook (Statistics Division

[3] The Catch, Effort and CPUE by Selected Gears section of the WPacFIN website has the statement "Output includes estimated weight landed, estimated effort (units are trips for boat-based fisheries and gear-hours fished for shore-based methods".

[4] The Catch, Effort and CPUE by Selected Gears section of the WPacFIN website has the statement "the resulting output includes …. commercial longline fishery data".

2021) indicates that in the period 2014–2018, the production of the major coastal commercial fisheries contracted by 26%.

- Covid is likely to be responsible for an accelerated decline in coastal commercial fishing in the 2020/21 period.

Table 20-1 on the 2019–2021 catches (above), indicates the estimate of coastal commercial production in 2021 was indeed very small but considering the points above, quite possible.

Discussions with staff of the Statistical Division and DMWR, together with information in WPRFMC (2022a) and the Agriculture Census (DOA 2020), provided information on fish prices. For the purposes of the present study, it will be assumed that in American Samoa the average price paid to fishers for the catch of coastal commercial fisheries in 2021 was US$7 per kg.

While the above information is inadequate for enabling a good estimate of the production of the coastal commercial fisheries of American Samoa, a crude approximation of the 2021 production would be about 15 t, worth US$105,000 to fishers.

### Coastal subsistence catches

American Samoa's subsistence fisheries include gleaning, throw-netting, spearfishing, handlining, and rod and reel. Cultural practices include fishing for palolo (*Eunice viridis*), atule (*Selar* spp.) and ia'sina (juvenile *Mulloidicthys* spp.) The major catches are atule from handlining, octopus from gleaning, bluelined surgeonfish from spearfishing and jacks *Caranx* spp. from rod and reel. There was a strong palolo rise in October 2018 (Ochavillo 2020).

WPRFMC (2022a) states that most nearshore fishermen in American Samoa do not sell their catch. Traditionally, fish in American Samoa are not sold but shared with others or distributed amongst the community. Many American Samoans still believe that some species, such as the palolo, should not be sold at the risk of ruining catch in future years. Sharing fish amongst the wider village community is still an important cultural practice. For example, atule are divided equally amongst village members after a group harvesting event, and palolo are still distributed to family members with a portion reserved for village pastors. However, since the advent of refrigeration, people are more likely to catch more fish during mass spawning events and share fewer as they can be stored for longer periods for personal use.

No recent information is readily available on the production from coastal subsistence fisheries in American Samoa. The older estimates for the production from subsistence fishing in American Samoa include the following:

- Dalzell et al. (1996) estimated 215 t (worth US$814,238) for the early 1990s.
- Spurgeon et al. (2004) reviewed several studies of various components of the subsistence fishery, which together give a subsistence production of 103 t.
- Zeller et al. (2005) used a "reconstruction approach" to show a remarkably large decline in subsistence catch rates on the main island of Tutuila over several decades. This was attributed to overexploitation of the coral reef fish – an explanation disputed by several fishery specialists with considerable local knowledge (M. Sabater and D. Hamm, per. com. September 2008; Sabater and Carroll 2008). However, the Zeller estimate of the 2002 subsistence catch of 121 t (Tutuila 39 t, outer islands 82 t) appears well substantiated.
- Gillett (2009a) indicated that the 2007 coastal subsistence production was likely to have been 120 t in 2007, worth US$478,000 to fishers.
- Gillett (2016) estimated that the 2014 coastal subsistence production was 120 t, worth about US$487,000 to fishers.

There is a general feeling among the staff at DMWR that in American Samoa (a) the coastal subsistence catch is greater than the coastal commercial catch, and (b) the difference between the two types of fisheries grew considerably in the Covid period. During hard economic times, people spend more time procuring their food, including fish, for home consumption – but this characteristic needs to be balanced with the declining population of American Samoa.

Reconciling some of the above information and that presented in the preceding section is not easy, which makes an assessment of the annual production from coastal subsistence difficult. For the purposes of the present study, it will be assumed that the 2021 coastal subsistence production was 100 t. Using the farm gate approach to valuing subsistence production, it was worth about US$490,000 to fishers.

### Locally based offshore catches

Some clarification of the structure of the locally based offshore fleet is required.

- In Table 20-2 below, the catches by American Samoa longliners are given for both the south Pacific Ocean and the north Pacific Ocean. For the purposes of the present study, only those catches in the south Pacific Ocean will be considered to be made by vessels based in American Samoa (i.e. locally based offshore caches).

- In this study, the locally based offshore fleet will be considered to consist solely of longline vessels. The purse seiners that frequent Pago Pago are not considered to be locally based for two reasons: (1) the centre of their economic activity does not lie in American Samoa as they come to the territory primarily for discharging their catch at a cannery; and (2) the country of registration (United States) implies, through official submissions to the Scientific Committee of the Western and Central Pacific Fisheries Commission, that the purse seiners are not based in American Samoa. In that submission (NMFS 2022), the terminology is "American Samoa-based longline vessels", but for the purse seiners, it is simply "U.S. purse seine vessels".
- The widespread use of "alia" catamaran fishing craft is unique to Samoa and American Samoa. Categorising the fishing activity of these 9-metre catamarans requires some special attention. While it is recognised that those vessels are not of industrial scale, due to the type of gear used and the difficulty and logic of separating the catch of those vessels from larger catamaran and mono-hull vessels, the catch from alia longliners in the present study is considered to be a component of the "offshore-locally based" catch.
- According to the staff of DMWR, in late 2021 the American Samoa longliners consisted of two alia and 13 larger mono-hulls.[5] In past decades, there were many alia longliners, but for various reasons (Box 20-2), the fleet is almost non-existent at present.

If any of the above assumptions are thought to be inappropriate, the estimated locally based offshore catch and associated value (given below) should be adjusted.

**Box 20-2:** The decline of the alia fleet in American Samoa

American Samoa's local alia fleet collapsed for a number of compounding reasons. Obtaining crew members to outfit alias was a significant challenge; the majority of fishing crew for the few operating alias are now from Western Samoa, as American Samoans prefer government jobs or military employment to working as a boat crew member or cannery employee. However, recent enforcement of immigration laws has made it more difficult to obtain foreign crew. In addition, cannery "leakage" of incidental catch from longliners is sold locally, providing large quantities of inexpensive fish to the local market in competition with fish caught and marketed by alias. Fish have also been imported from Western Samoa for the past 20 years, and now daily imports of fish from Western Samoa serve to drive down the price of fish in American Samoa. These factors, as well as an increase in fuel prices and vessel and engine breakdown and repair problems, combined to make small scale alia operations challenging and largely unprofitable in American Samoa.

Source: Levine and Allen (2009)

[5] This is nine vessels less than that reported in the table 20-2.

The catches by the American Samoa-based longline fleet (Table 20-2) are given in the submission by the United States to the Scientific Committee of the Western and Central Pacific Fisheries Commission.

Table 20-2 Catches by American Samoa longline vessels

| | American Samoa (NPO) | | | | | American Samoa (SPO) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2020 | 2019 | 2018 | 2017 | 2021 | 2020 | 2019 | 2018 | 2017 |
| Number of vessels | 24 | 122 | 127 | 113 | 118 | 11 | 11 | 18 | 14 | 15 |
| Albacore, NPO (t) | 30 | 8 | 12 | 11 | 17 | | | | | |
| Albacore, SPO (t) | 0 | 0 | 0 | 0 | 0 | 685 | 540 | 1,050 | 1,542 | 1,495 |
| Bigeye tuna (t) | 404 | 1,563 | 1,514 | 798 | 1,346 | 24 | 23 | 31 | 53 | 63 |
| Pacific blue-fin tuna (t) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Skipjack tuna (t) | 15 | 16 | 28 | 15 | 36 | 40 | 62 | 69 | 76 | 71 |
| Yellowfin tuna (t) | 275 | 160 | 220 | 209 | 311 | 246 | 223 | 189 | 261 | 559 |
| **Total tunas (t)** | **724** | **1,747** | **1,774** | **1,034** | **1,709** | **994** | **848** | **1,339** | **1,934** | **2,190** |

Source: NMFS (2022); NPO = north Pacific Ocean; SPO = south Pacific Ocean

Taking the above amounts of tuna (994 t for the SPO in 2021), the tuna prices from the Forum Fisheries Agency (FFA 2022a) and considering the value of the bycatch, the American Samoa dockside value to the fishers of the 2021 catch of is estimated to be US$3.0 million.

## Foreign-based offshore catches

All of the longline catch in the zone is from locally based vessels and is included in the locally based offshore catches above. Any purse seine catches made in the waters of American Samoa were by U.S. vessels, which are not considered foreign vessels.

## Freshwater catches

Craig (2009) states that Tutuila has about 141 streams that support about a dozen important native species of freshwater fish and invertebrates. The principal groups are eels, gobies, mountain bass, shrimp and snails.

No catch estimates of the production from freshwater fishing have been made. For the purposes of this study, it is estimated that the annual catch is 1 t, worth US$4,900.

## Aquaculture harvests

The Census of Agriculture American Samoa (DOA 2020) indicates there were 14 aquaculture farms in American Samoa in 2018 (53 farms in 2008). In 2018 they sold 21 t, while 28 t were used by the farm families.

The staff of the DMWR indicate that the only current aquaculture production of American Samoa is a very small amount of tilapia.

For the purposes of the present study, the aquaculture production of American Samoa in 2021 is deemed to be 10 t, with a farm gate value of US$49,000.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values[6] of the fishery and aquaculture harvests in 2021 can be made (Table 20-3).

**Table 20-3:** Annual fisheries and aquaculture harvest in American Samoa in 2021

| Harvest sector | Volume (t) | Value (US$) |
|---|---|---|
| Coastal commercial | 15 | 105,000 |
| Coastal subsistence | 100 | 490,000 |
| Offshore locally based | 994 | 3,000,000 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 1 | 4,900 |
| Aquaculture | 10 | 49,000 |
| **Total** | **1,120** | **3,648,900** |

6 The values in the table are dockside/farm gate prices.

Figures 20-1 and 20-2 show the volumes and values of the 2021 American Samoa fisheries production.

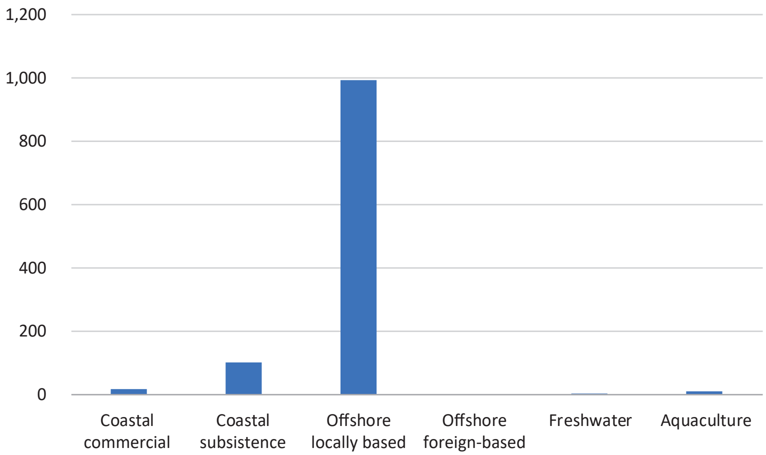



**Figure 20-1:** American Samoa fisheries and aquaculture production in 2021 by volume (t)

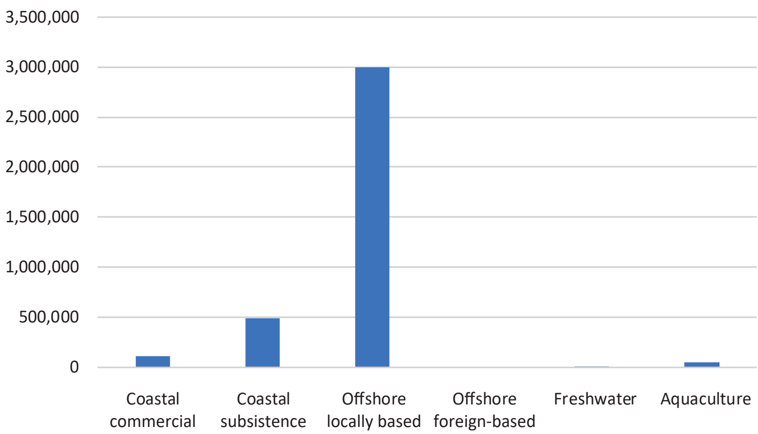



**Figure 20-2:** American Samoa fisheries and aquaculture production in 2021 by value (US$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The estimated fishery production levels for American Samoa from those three studies are presented in Table 20-4.[7]

**Table 20-4:** Estimates by the Benefish studies of annual fisheries harvests

| Harvest sector | Estimate year | Volume (t) | Nominal value (US$) |
|---|---|---|---|
| Coastal commercial | 1999 | n/a | n/a |
| | 2007 | 35 | 166,000 |
| | 2014 | 42 | 244,000 |
| | 2021 | 15 | 105,000 |
| Coastal subsistence | 1999 | n/a | n/a |
| | 2007 | 120 | 478,000 |
| | 2014 | 120 | 487,000 |
| | 2021 | 100 | 490,000 |
| Offshore locally based | 1999 | n/a | n/a |
| | 2007 | 6,632 | 14,135,083 |
| | 2014 | 2,154 | 5,113,395 |
| | 2021 | 994 | 3,000,000 |
| Offshore foreign-based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 1 | 4,000 |
| | 2014 | 1 | 4,000 |
| | 2021 | 1 | 4,900 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 9 | 10,000 |
| | 2014 | 9 | 44,500 |
| | 2021 | 10 | 49,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an

[7] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

improvement), or that new and better information has become available. In the table above, the production levels for coastal commercial fishing change between the years (remarkably in 2021), but some of that change is due to new/better information. In contrast, changes in production figures in the table for locally based offshore fishing (based on the historical availability of better-quality data) likely reflect real changes in the amounts being harvested.

## 20.2 Contribution of fishing to GDP

### Current official contribution

Estimates of the GDP of American Samoa are made by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce, under the Statistical Improvement Program funded by the Office of Insular Affairs of the U.S. Department of the Interior. The BEA also makes GDP estimates for Guam, the Northern Mariana Islands and the U.S. Virgin Islands.

The BEA estimated that the GDP of American Samoa was US$716 million in 2020 and US$709 in 2021 (BEA 2022). The fishing contribution to GDP is not given in BEA documentation, and the staff of the Statistics Division of the American Samoa Department of Commerce are unaware of the amount of the fishing contribution.

### Method used to calculate the official fishing contribution to GDP

The national accounts of American Samoa are at a rudimentary stage of development. As mentioned above, the BEA estimates the GDP for the Department of Commerce of the American Samoa Government. Staff of the Statistics Division of the Department of Commerce are unsure of the methodology used to calculate the GDP, or whether those calculations even have a fishing component (M. Filiga, per. com. October 2022).

BEA documentation on its GDP estimation methodology (BEA undated) states that the GDP for American Samoa is estimated using the expenditures approach, i.e. as the sum of goods and services sold to final users. It is calculated by summing personal consumption expenditures, private fixed investment, change in private inventories, net exports of goods and services, and government consumption expenditures and gross investment. BEA relies on territorial government data in conjunction with the limited federal data that are available for its annual estimates of territory GDP. No indication is given in the readily available BEA documentation of how it treats the fishing sector for GDP purposes.

## Estimate of fishing contribution to GDP

Table 20-5 (below) represents one method for estimating fishing contribution to GDP in American Samoa. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 20.1 above (summarised in Table 20-3) and determines the value added by using value-added ratios (VARs) characteristic of the type of fishing concerned. Those VARs were determined by a knowledge of the fisheries sector and by using specialised studies (Appendix 3).

**Table 20-5:** Fishing contribution to American Samoa GDP in 2021

| Harvest sector | Gross value of production (US$, from Table 20-3) | VAR | Value added (US$) |
|---|---|---|---|
| Coastal commercial | 105,000 | 0.69 | 72,450 |
| Coastal subsistence | 490,000 | 0.85 | 416,500 |
| Offshore locally Based | 3,000,000 | 0.25 | 750,000 |
| Freshwater | 4,900 | 0.90 | 4,410 |
| Aquaculture | 49,000 | 0.74 | 36,260 |
| **Total** | **3,648,900** | --- | **1,279,620** |

The contribution of fishing to GDP in 2021 estimated in the table ($1.28 million) represents about 0.18% of the US$709 million GDP estimate for American Samoa for 2021.

## 20.3 Exports of fishery production

The fishery exports of American Samoa consist largely of canned tuna and by-products of the canneries. Table 20-6 (from Statistics Division [2021]) shows the annual values of the fishery exports and compares them with the value of all domestic exports. The latest year for which the fishery exports are readily available is 2019.

Table 20-6: Value of fishery product exports

| | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|
| Fish meal | 11,931 | 3,400 | 0 | 0 | 0 |
| Canned tuna | 365,587 | 371,214 | 307,732 | 374,919 | 351,470 |
| Pet food | 0 | 0 | 0 | 0 | 0 |
| Other domestic exports | 1,014 | 10,538 | 1,489 | 2,394 | 1,745 |
| Total domestic exports | 378,532 | 385,152 | 309,221 | 377,313 | 353,215 |
| Fishery products as a % of total domestic exports | 99.7% | 97.3% | 99.5% | 99.4% | 99.5% |

Units = US$ thousands

## 20.4 Government revenue from fisheries

### Access fees for offshore fishing

There is currently no foreign fishing in the American Samoa zone. United States vessels are considered to be domestic vessels.

### Other government revenue from fisheries

The Department of Marine and Wildlife Resources issues several fishing licences per month, at a cost of US$10 per license. The revenue generated is deposited in the general fund of the Government of American Samoa.

Information on other forms of government revenue from the fisheries sector in American Samoa is not readily available.

## 20.5 Fisheries-related employment

Employment in American Samoa that is directly related to fisheries has two distinct main components: involvement in activities related to fishing and jobs at tuna canneries. The background of the canneries (Box 20-3) is important for an understanding of their importance in fisheries-related employment in American Samoa.

**Box 20-3:** Tuna canning in American Samoa

In the late 1940s the British colony of Fiji was developing a tuna fleet. Because the market for tuna at that time was almost exclusively in the U.S., access to American consumers under favourable import tariff conditions was considered essential. Using the legal provision which allow products produced in American Samoa duty-free access to American markets, a Fiji fishing company was instrumental in establishing a small canning operation in Pago Pago. The cannery was not able to operate profitably on this inconsistent supply, processed only 6 tonnes of fish, and soon closed. The American Samoa government eventually purchased the cannery for $40,000.

After the first cannery attempt, American Samoa obtained additional legal advantages when in 1953 the unloading of fish by non-U.S. flag vessels directly in Pago Pago was allowed. This change enticed the Van Camp Seafood Company to establish a cannery at the site of the original venture. In 1963, Starkist Foods opened a second cannery alongside Van Camp.

The canneries represent the largest private sector source of employment in the region, and, until recently, were the principal industry in the Territory. Although as many as 90% of cannery workers are not American Samoa citizens, the canneries play a large role in the American Samoa economy (e.g., delivering goods or services to tuna processors and improving buying patterns of cannery workers). Trends in world trade, specifically reductions in tariffs, have been reducing the competitive advantage of American Samoa's duty-free access to the U.S. canned tuna market, and the viability of the canneries has been in question for nearly the past decade. In 2009, the Chicken of the Sea cannery closed, resulting in a loss of approximately 2,000 jobs. It was bought by Tri Marine International, which invested $70 million in rebuilding and expansion, and reopened in 2015. In October 2016, Starkist suspended operations due to lack of fish. That same month, Tri Marine International announced that it would suspend production indefinitely in December 2016, and there are currently no plans to reopen (Pacific Islands Report 2017). Starkist Samoa is currently the only cannery operating in American Samoa and is the largest private employer with about 2,000 workers.

Source: Gillett (1994b) and WPRFMC (2022a)

The American Samoa Statistical Yearbook (Statistics Division 2021) indicates that in 2019 the cannery employed 2,533 people, which was 15% of all formal employment in American Samoa. It also states that the "number of fishermen" was 126 in 2018 – which probably refers to the number of people involved in a certain fisheries sub-sector, such as boat-based fishing.

The latest household income and expenditure survey (2015) is not very useful for fisheries-related employment as fisheries employment is aggregated and reported with farming and forestry.

The Annual Stock Assessment and Fishery Evaluation Report for the American Samoa Archipelago Fishery Ecosystem Plan 2021 (WPRFMC 2022a) comments on gender roles in fishing:

While the gender division in fishing is not as strict as it was in the past, women and children still predominantly engage in gathering shellfish and small fish in the intertidal zone, while men fish farther offshore. Traditionally, women were not permitted by Samoan custom to fish outside the reef.

## 20.6 Levels of fishery resource consumption

Staff of the Statistics Division of the Department of Commerce and of the Department of Marine and Wildlife Resources in American Samoa indicate that they are not aware of any recent surveys covering fish consumption in the territory. The following information comes from earlier studies:

- Gillett and Preston (1997) estimate that the production from coastal fisheries (commercial and subsistence) in American Samoa in the early 1990s equated to an annual per capita fish supply of 5.7 kg.
- Craig et al. (2008) examined fish consumption in the outer islands of American Samoa. The per capita catch in 2002 was 71 kg/person, of which 63 kg/person was consumed, and the remainder was sent to family members on the main island of Tutuila. The annual subsistence harvest of 37.5 t consisted of the coastal pelagic bigeye scad (*Selar crumenophthalmus*) (31%), reef-associated fish (57%) and invertebrates (12%).

The present study estimates the production from coastal fisheries (commercial and subsistence), freshwater and aquaculture in American Samoa in 2021 to be 126 t. This equates to 2.2 kg per person per year (whole fish equivalent). It is difficult to determine the actual annual per capita consumption of fish in American Samoa from this information because the amounts of fish from other contributors to the domestic fish supply are not readily available, including: (1) fish from the locally based offshore fleet that is consumed domestically, (2) the "leakage" of fish from foreign-based offshore fishing vessels that offload in American Samoa, (3) imports of fishery products, and (4) the products of the American Samoa canneries that are domestically consumed.

Levine et al. (2016) found that American Samoans consume seafood frequently, with 78% of respondents stating that they eat fish or seafood once a week or more. Most American Samoans purchase seafood from stores or restaurants, with 65% of survey respondents listing these sellers as their first or second choice for obtaining seafood. Other common means for obtaining fish include markets and roadside vendors (45%), and fish caught by household members (37%). These results corroborate the observation that American

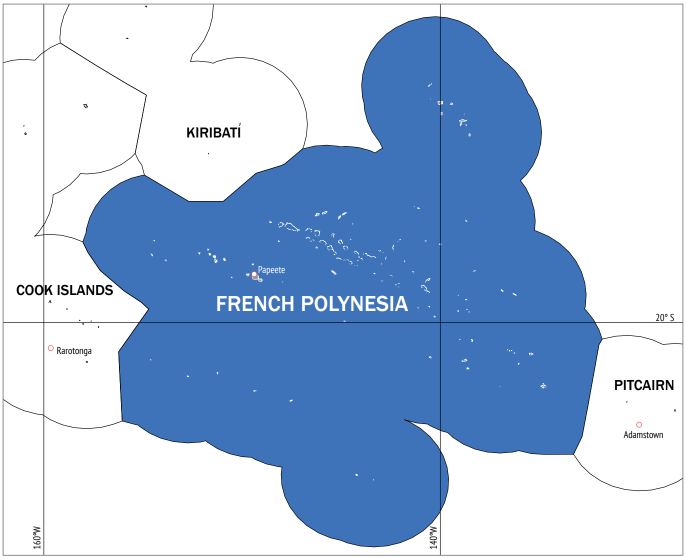
Samoans largely rely on, and in many cases prefer, store-bought food to locally caught fish, with the majority of fish consumed in American Samoa imported from neighbouring Samoa.

The 2015 American Samoa household income and expenditure survey (Statistics Division 2015) found that the most popular forms of seafood consumed (in decreasing order of importance by money spent) were: fresh fish/seafood, canned mackerel, canned tuna, processed fish/seafood and canned sardines.

## 20.7 Exchange rates

American Samoa uses the US dollar (US$).

# 21 French Polynesia




## 21.1 Volumes and values of fish harvest in French Polynesia

### Coastal commercial catches in French Polynesia

The government fisheries agency in French Polynesia is the Direction des Ressources Marines (DRM). That agency groups the fisheries of French Polynesia into three categories: lagoon, coastal and offshore. The "coastal fisheries" in that categorisation scheme does not correspond to the "coastal fisheries" of the present study – DRM's use of the term relates to fishing in the open ocean using relatively small vessels. The lagoon and coastal DRM categories together correspond with the combined coastal commercial and coastal subsistence categories used in the present study and earlier Benefish studies.

Some of the historical studies of coastal fishing in French Polynesia are:

- Dalzell et al. (1996) estimated a coastal commercial fisheries production of 2,352 tonnes (t), worth US$14,371,469, and a coastal subsistence catch of 3,691 t, worth US$14,468,720.
- Gillett (2009a) used the available data and modified them to fit the different categories of the 2009 study. It was estimated that the coastal commercial fishery production of French Polynesia in 2007 was 4,002 t, worth XPF 2 billion to fishers.

- Gillett (2016) examined the earlier estimates, studied recent factors that could have conceivably affected coastal fisheries production (e.g. longline catch, improved air cargo service) and estimated the coastal commercial fisheries of French Polynesia (i.e. the commercial portion of DRM's categories "lagoon" and "coastal") in 2014 to be 5,666 t, worth XPF 3,052,588,235 to the fishers.

The DRM Statistical Bulletin (DRM 2022a) states that despite the lack of good statistics on lagoon fishery production, it is possible to estimate the 2021 production from lagoon fisheries in the territory as 4,300 t, which comprises 3,400 t of lagoon fish, 700 t of small pelagics and 200 t of other products (molluscs, crustaceans, echinoderms, etc.) The total value to fishers is estimated to be XPF 2 billion. As DRM has considerable fisheries expertise, the present study does not dispute the volume of this estimate, but notes that this statement has appeared in DRM Statistical Bulletins for many years.[1] To transform this older DRM lagoon fishery estimate to an estimate of 2021 coastal commercial fishing for the present study, the following would be reasonable:

- Increase the value of the catch to 2021 values.
- Separate the DRM estimate into commercial and subsistence components.
- Add the volume and value of the bonitier and poti marara catches (i.e. "*la pêche côtière*").
- Make some adjustments for factors that could have recently affected catches of the lagoon fishery.

In the 13 years since the survey that led to the DRM estimate of lagoon fishery production, prices have increased considerably. Unpublished data from the Institut de la Statistique de la Polynesie Francaise (ISPF) show that fish prices in general have increased about 20% during the period.

Senior staff of DRM indicated during the present study and during Gillett (2016)study that the proportion of lagoon fishery production that is sold has increased and is now approximately equal to subsistence catches (A. Stein, per. com. September 2015; C. Ponsonnet, per. com. December 2022).

As for the volume and value of the bonitier and poti marara catches in 2021, using catch data from DRM (2022b) and unpublished price data from ISPF, Table 21-1 can be constructed:

[1] Identical wording appears in the 2009 Statistical Bulletin.

**Table 21-1:** 2021 Catch and value of bonitier and poti marara fleets

| Species | Total catch (t) | Price at first sale (XPF/KG) | Total value (XPF) |
|---|---|---|---|
| Skipjack | 391 | 500 | 195,500,000 |
| Yellowfin | 887 | 600 | 532,200,000 |
| Dolphinfish | 160 | 850 | 136,000,000 |
| Billfish | 239 | 500 | 119,500,000 |
| Wahoo | 55 | 425 | 23,375,000 |
| Albacore | 275 | 600 | 165,000,000 |
| Other | 169 | 450 | 76,050,000 |
| **Total** | **2,176** | | **1,247,625,000** |

A major recent factor affecting the volume and value of catches of lagoon fishery in French Polynesia was Covid. Much of the commercial lagoon fishing in French Polynesia occurs in the lagoons of the Tuamotu Archipelago for shipment to markets in Tahiti. DRM (2022a) estimates 691 t of lagoon fish in this trade annually. During the Covid period, because of reduced transport to Tahiti, the commercial lagoon fishing of the Tuamotu Archipelago was considerable reduced. Also to be considered is that the fish catches from the Tahiti-based longliners, when marketed in Tahiti, can reduce demand for lagoon species. The production from those longliners did not decline during Covid, but exports were curtailed due to lack of overseas air service, putting a substantial amount of additional longline fish on the Tahiti market.

Another factor affecting the production of lagoon fisheries in the territory is pearl farming. Increases or decreases in pearl production (mostly in the Tuamotu Archipelago) affect the level of fisheries production because there are limited employment alternatives in that area. DRM (2022a) indicates that the number of registered pearl producers was roughly the same in 2021 as it was in 2008.

Some less dominant factors affecting the value of the coastal commercial fisheries are that the fishery for aquarium products reached a height in 2021 (XPF 50.7 million free-on-board [FOB] value), while there were no exports of sea cucumbers in 2021.

Selectively using the above information, Table 21-2 can be constructed.

**Table 21-2:** Estimate of the volume and value of commercial fishing in French Polynesia in 2021

| | Volume (t) | Value (XPF) | Notes |
|---|---|---|---|
| All lagoon fishing as per DRM (2008) estimate, repeated in DRM (2022a) | 4,300 | 2,000,000,000 | |
| Lagoon commercial fishing (half of above) | 2,150 | 1,000,000,000 | As per the idea that the proportion of lagoon fishery production that is sold is now approximately equal to subsistence catches |
| Adjustment for increase in price of fish in period 2008–2021 | --- | 1,200,000,000 | ISPF data show an increase about 20% during the 2008–2021 period |
| Volume adjustment for recent events | Less 325 | --- | Mainly for Covid |
| Bonitier and poti marara fishing in 2021 | 1,740 | 998,100,000 | Assumes that 80% of the catch is commercial |
| **Total** | **3,565** | **2,198,100,000** | |

A crude estimate of the coastal commercial fisheries production of French Polynesia in 2021 is 3,565 t, worth XPF 2,198,100,000 to the fishers.

## Coastal subsistence catches

As stated in the section above, of the 4,300 t catch from lagoon fisheries, it is estimated that half (i.e. 2,150 t) is commercial and half is non-commercial. To obtain total coastal subsistence production, the recreational and "semi-commercial" catch made outside the reef must be considered. This production is not covered by the statistical system but is probably in the order of several hundred tonnes (A. Stein, per. com. December 2015). For the purposes of the present study, the catches from recreational fishing are considered as production for home consumption and therefore as a component of subsistence fisheries.

The total coastal subsistence catch in French Polynesia in 2021 is estimated to be 2,350 t. Using the farm gate method for valuing subsistence production, it is worth XPF 1,014,270,546 to the fishers.

## Locally based offshore catches

The French Polynesia offshore tuna fleet in 2021 was comprised of 73 tuna longliners (ranging from 13 m to 24 m) operating exclusively within the French Polynesia exclusive economic zone. The vessel sizes are given in Table 21-3.

Table 21-3: Size categories of the offshore fleet in 2021

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| 00–50 GRT | 34 | 37 | 37 | 36 | 37 |
| 51–200 GRT | 27 | 29 | 32 | 36 | 36 |
| 201–500 GRT | 0 | 0 | 0 | 0 | 0 |
| 500+ GRT | 0 | 0 | 0 | 0 | 0 |
| **Total vessels** | **61** | **66** | **69** | **72** | **73** |

Source: DRM (2022b); GRT = gross registered tonnage

The French Polynesia Annual Report to the Scientific Committee of the Western and Central Pacific Fisheries Commission (DRM 2022b) gives the catches of the locally based longliners (Table 21-4).

Table 21-4: Catches of the locally based longliners 2017–2021 (t)

| | 2017 | 2018 | 2019 | 2020 | | 2021 | |
|---|---|---|---|---|---|---|---|
| | | | | Retained | Discarded | Retained | Discarded |
| Albacore | 2,148 | 3,058 | 3,393 | 2,780 | 31 | 2,662 | 27 |
| Bigeye | 897 | 1,063 | 934 | 855 | 16 | 1,020 | 25 |
| Pacific bluefin | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Skipjack | 37 | 31 | 14 | 14 | 40 | 13 | 66 |
| Yellowfin | 1,434 | 1,314 | 1,309 | 1,080 | 56 | 2,219 | 131 |
| Black marlin | 21 | 16 | 11 | 18 | 0 | 18 | 2 |
| Blue marlin | 163 | 224 | 274 | 240 | 7 | 173 | 3 |
| Striped marlin | 73 | 81 | 88 | 97 | 2 | 128 | 1 |
| Swordfish | 150 | 219 | 168 | 162 | 15 | 172 | 2 |
| **Total** | **4,923** | **6,006** | **6,191** | **5,245** | **168** | **6,405** | **257** |

The total landed catch in 2021 was 6,405 t. Albacore, yellowfin and bigeye made up 87% of the total commercial production. The main non-tuna component (in decreasing importance) was wahoo, blue marlin, swordfish and striped marlin.

In a normal year, longline exports are about one third of the landed catch, with the balance being for domestic consumption. As mentioned above, during the Covid period, the longliner production did not decline much, but exports were curtailed due to reduced overseas air service, putting a substantial amount of additional longline fish on the Tahiti market.

Assuming the average price at first sale in 2021 was 700 XPF/kg for the three species of tuna and that for the non-tuna species was 600 XPF/kg, the 2021 longline catch of 6,405 t is valued at 4,434,400,000 XPF (4,139,800,000 XPF + 294,600,000 XPF).

### Foreign-based offshore catches

There has not been any legal foreign fishing inside the French Polynesia exclusive economic zone since December 2000.

### Freshwater catches

Keith et al. (2002) give information on the freshwater fishes and crustaceans of French Polynesia. They indicate that there are 37 species of freshwater fish and 18 species of decapod crustaceans.

The most important of these for fishery purposes are the juvenile gobies (*Sicyopterus lagocephalus* and *S. pugnans*), *Macrobrachium*, tilapia, *Kuhlia* spp. and eels. No official estimate is made of the production from freshwater fishing in French Polynesia, but staff of Service de la Pêche familiar with the situation indicate that although catches fluctuate considerably, 100 t per year could be considered an average (A. Stein, per. com. November 2015). No major changes in the fishery have been noted in the last decade.

If this 100 t of freshwater fisheries production is valued in a manner similar to that for coastal subsistence fisheries in French Polynesia (above), it would be worth XPF 43,800,000.

### Aquaculture Production

Aquaculture in French Polynesia is dominated by pearl farming, but the total production of pearl farming is not well known. This is due to both underreporting and non-declaration of exports. According to the DRM Statistical Bulletin (DRM 2022a), in 2021 there were 8,136 hectares of pearl farms, which is 0.26% less than in the previous year. Of the 8,136 hectares, 72% are in the Tuamotu Archipelago. According to the Institut d'Émission d'Outre-mer (IEOM 2022a), pearls are cultured on about 15 atolls in French Polynesia. Of the 8.5 million pearls produced in 2021, 64% came from Tuamotu and 34% from Gambier.

The impact of Covid on pearl culture was mainly on the marketing of pearls. International sales were severely restricted and consequently, many pearls were stockpiled for sale in the future.

To estimate aquaculture production in French Polynesia for the present study, a considerable amount of discussion and back/forth with the head of DRM's aquaculture section were required. This enabled the construction of Table 21-5 below.

**Table 21-5:** French Polynesia aquaculture production in 2021

| Commodity | Volume | | Farm gate value XPF | Notes |
|---|---|---|---|---|
| | Tonnes | Pieces | | |
| Pearl oyster culture | | | | |
| Pearls | | 8,558,771 | 5,290,400,000 | The volume given here is derived from the "perles contrôlées" of page 35 of DRM (2022a). The pearl exports of page 58 of DRM (2022a) include a significant amount of pearls stockpiled from the production of previous years. The 2021 average export price is assumed to be XPF282/gram, which is deflated by 15% to give a farm gate price of XPF240/gram. The deflation is relatively low compared to other aquaculture commodities due the non-perishable nature of pearls. |
| Pearl shell | 1,365 | | 176,000,000 | Assumes the FOB value given in DRM (2022a) of XPF 176 million can be deflated by 25% to approximate farm gate value. |
| Shrimp | 161.4 | | 342,168,000 | Assumes a farm gate price per kg of XPF2,120 |
| Giant clams | | 15,241 | 4,500,000 | Assumes (a) the aquaculture production consists of the number of "collectage" (i.e spat collection) and the "écloserie" (i.e hatchery) giant clams given in DRM (2022a), and (b) the total FOB value of giant clam exports in 2021 was XPF49.6 million as given in DRM (2022a), of which 60% (XPF29.7 million) is for clam aquaculture exports. This can be deflated by 85% to approximate a farm gate value of XPF4.5 million. |
| Batfish | 15.3 | | 33,660,000 | Assumes a farm gate price of XPF2,200 per kg |
| **Total** | **1,541.7** | **8,574,012** | **5,846,728,000** | **@114.6 = US$51.0 million** |

Source: DRM (2022a) and information kindly supplied by G. Remoissenet (per. com. November 2022).

In addition to the above commodities, the following are farmed (or have been farmed in the recent past) in French Polynesia on a small or experimental scale: sea cucumbers, rock oysters, sunfish, tilapia (in aquaponics) and various seaweeds.

The total aquaculture production of French Polynesia in 2021 is estimated to be 1,542 t plus 8,574,012 pieces, with a farm gate value of XPF 5,846,728,000.

## Summary of harvests

An approximation of the annual volumes and values of the fisheries and aquaculture production in French Polynesia in 2021 is given in Table 21-6.

**Table 21-6:** Annual fisheries and aquaculture harvest in French Polynesia in 2021

| Harvest sector | Volume (t and pcs) | Value (XPF) |
|---|---|---|
| Coastal commercial | 3,565 | 2,198,100,000 |
| Coastal subsistence | 2,350 | 1,014,270,546 |
| Offshore locally based | 6,405 | 4,434,400,000 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 100 | 43,800,000 |
| Aquaculture | 1,542 t and 8,574,012 pcs | 5,846,728,000 |
| **Total** | **13,962 t and 8,574,012 pcs** | **13,537,298,546** |

Figures 21-1 and 21-2 show the volumes and values of French Polynesia fisheries production in 2021. Aquaculture is not shown in the volumes figure due to the use of mixed units (tonnes and pieces).

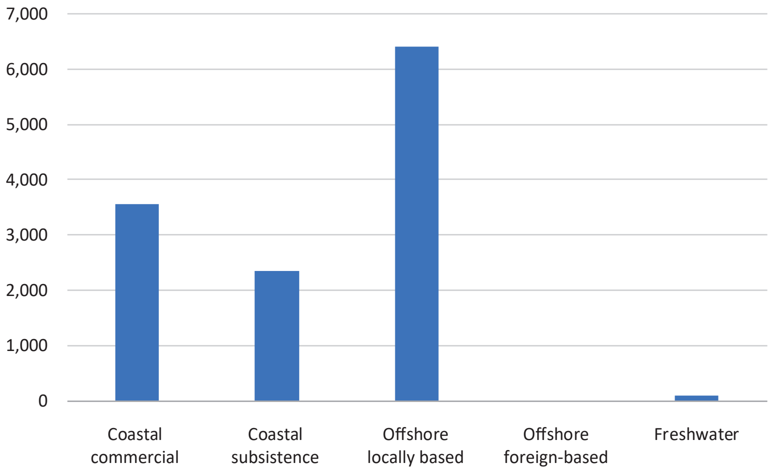



**Figure 21-1:** French Polynesia fisheries production in 2021 by volume (t)

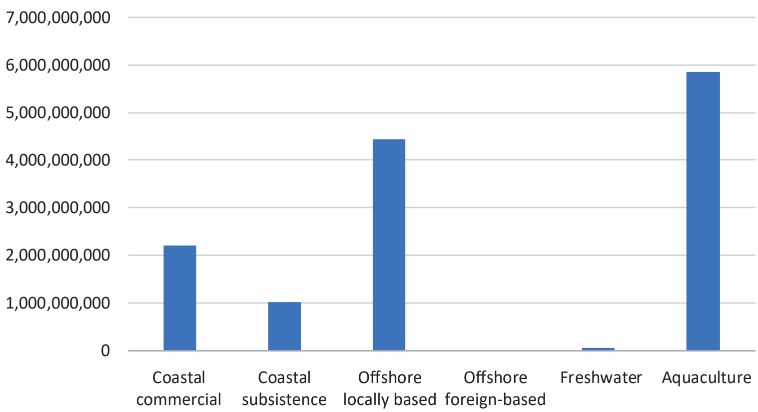



**Figure 21-2:** French Polynesia fisheries and aquaculture production in 2021 by value (XPF)

## Past estimates of fisheries production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The estimated fishery production levels for French Polynesia from these studies are shown in Table 21-7.[2]

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an improvement). In the table above the production levels for coastal commercial, coastal subsistence and freshwater change significantly between the years, but some of that change is due to the way in which the production was estimated. In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better-quality data) likely reflect real changes in the amounts being harvested.

[2] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

**Table 21-7:** Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (XPF) |
|---|---|---|---|
| Coastal commercial | 1999 | n/a | n/a |
| | 2007 | 4,002 | 2,001,400,000 |
| | 2014 | 5,666 | 3,052,588,235 |
| | 2021 | 3,565 | 2,198,100,000 |
| Coastal subsistence | 1999 | n/a | n/a |
| | 2007 | 2,880 | 1,149,120,000 |
| | 2014 | 2,350 | 1,125,171,000 |
| | 2021 | 2,350 | 1,014,270,546 |
| Offshore locally based | 1999 | n/a | n/a |
| | 2007 | 6,308 | 2,457,515,000 |
| | 2014 | 5,390 | 2,829,000,000 |
| | 2021 | 6,405 | 4,434,400,000 |
| Offshore foreign-based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 100 | 42,500,000 |
| | 2014 | 100 | 47,879,616 |
| | 2021 | 100 | 43,800,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 56 | 10,762,600,000 |
| | 2014 | 8,361,500 pcs and 101 t | 8,809,250,000 |
| | 2021 | 8,574,012 pcs and 1,542 t | 5,846,728,000 |

## 21.2 Contribution of fishing to GDP

### Current official contribution

According to ISPF staff, the last year for which detailed estimates of GDP for French Polynesia were made was 2018 (A. Ailloud, per. com. December 2022). ISPF (2022a) gives the GDP (current prices) for 2018 as XPF 626,899,000,000.

ISPF unpublished data show:

- XPF 3,915,000,000 valued added for pearl culture for 2018.
- XPF 8,301,000,000 valued added for non-pearl aquaculture and fisheries for 2018.
- XPF 12,216,000,000 valued added for total aquaculture and fisheries for 2018.

As the 2018 GDP is XPF 626,899,000,000, the total aquaculture and fisheries valued added equates to 1.95% of GDP in that year.

### Method used to calculate the official fishing contribution to GDP

According to ISPF staff (A. Ailloud, per. com. December 2022), important aspects of the method for calculating the contribution of fishing and aquaculture to GDP are as follows:

- The price paid to fishers is the retail fish of price divided by 1.35 (denominator adopted by the ISPF).
- The current base year for GDP estimations is 2005, and the methodology has changed little since then (including for the fisheries sector).
- The contribution of pearl culture to GDP is calculated separately to that of lagoon/coastal/offshore fishing and non-pearl aquaculture.
- The value-added ratio (VAR) used for pearl culture is 44.8%.
- The VAR used for non-pearl aquaculture and fisheries is 38.5%.

The only obvious comment to be made on the above methodology concerns the value-added ratio for the non-pearl aquaculture and fisheries. Using the same ratio for all types of fishing (ranging from industrial longlining to small-scale lagoon fishing) appears to be sub-optimal. Refining VARs for specific fishery sub-sectors could provide much better estimates of value added. For example, using a VAR of 0.90 for non-motorised fishing and a VAR of 0.20 for longlining, instead of a VAR of 38.5% for a category that includes both types of fishing.

## Alternative estimate of fishing contribution to GDP

Table 21-8 (below) represents an alternative to the official method of estimating fishing contribution to GDP in French Polynesia. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 21.1 above (summarised in Table 21-6) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3). The VAR for pearl culture was determined by examining actual company accounts of pearl culture operations in the Cook Islands and Fiji.

Table 21-8 (below) is for 2021, whereas the latest results of the official method for estimating fishing contribution to GDP in French Polynesia are for 2018.

It is not intended that the approach in Table 21-8 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

**Table 21-8:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (XPF, from Table 21-6) | VAR | Value added (XPF) |
|---|---|---|---|
| Coastal commercial | 2,198,100,000 | 0.55 | 1,208,955,000 |
| Coastal subsistence | 1,014,270,546 | 0.70 | 709,989,382 |
| Offshore locally based | 4,434,400,000 | 0.20 | 886,880,000 |
| Freshwater | 43,800,000 | 0.85 | 37,230,000 |
| Aquaculture | 5,846,728,000 | 0.45 | 2,631,027,600 |
| **Total (XPF)** | **13,537,298,546** | --- | **5,474,081,982** |

From the table, a total contribution from fishing/aquaculture of XPF 5,474 million is estimated for 2021. In the section above on the official contribution, an official contribution of XPF 12,216 million was estimated for 2018. At least part of the difference is that the alternative approach is for a year in which fisheries and aquaculture production was depressed due to Covid. Some of the difference could be due to the use of different VARs. In comparing the gross value of production in the two categories, i.e. (1) pearl culture and (2) lagoon/coastal/offshore fishing and non-pearl aquaculture, between Table 21-8 (above) and that in the ISPF unpublished data, it is apparent that the ISSF production values are much higher for both categories. It is the contention of the present study that the values in the above table for category #2 are likely to be more accurate than those of ISPF.

## 21.3 Exports of fishery production

Using customs data, ISPF compiled information on non-pearl fishery exports of the territory (Table 21-9).

**Table 21-9:** Non-pearl fishery exports of French Polynesia

| | 2020 | 2021 |
|---|---|---|
| Pelagic fish | 782 | 1,685 |
| Whole chilled | 665 | 1,521 |
| Whole frozen | 14 | 5 |
| Chilled fillets | 10 | 27 |
| Frozen fillets | 93 | 132 |
| Live fish | 28 | 51 |
| Molluscs, crustaceans, and other invertebrates | 44 | 50 |
| Molluscs | 44 | 50 |
| Other invertebrates | 0.2 | 0 |
| Crustaceans | 0 | 0 |
| Shells | 190 | 186 |
| **Total** | **1,044** | **1,972** |

Source: ISPF (2022a) Units = millions of XPF

Detailed information on the pearl exports of French Polynesia is given the DRM Statistical Bulletin (Table 21-10).

**Table 21-10**: Pearl exports

| | Volume (t) | FOB value (XPF millions) |
|---|---|---|
| 2017 | 14.7 | 8,117 |
| 2018 | 12.4 | 7,463 |
| 2019 | 10.1 | 4,870 |
| 2020 | 8.9 | 2,380 |
| 2021 | 16.9 | 4,751 |

Source: (DRM 2022a)

With total exports of local products of French Polynesia in 2021 of XPF 9,341 million (IEOM 2022a), the value of pearl and non-pearl exports (XPF 6,723 million in 2021) equates to 72% of all exports from the territory in that year.

Other notable features of the export of fishery products of French Polynesia are:

- Tracking pearl exports, unlike that for many of the other fishery products, are complicated by the fact that pearls are often stockpiled when market conditions are poor, so the relationship between annual production and annual exports is not straightforward.
- Because of sea cucumber harvesting restrictions in 2021, there were no beche-de-mer exports in 2021. In some years (e.g. 2011 and 2012), the value of exports of that commodity was over XPF 100 million.
- Lagoon fish are rarely exported from French Polynesia due to concerns over ciguatera.
- IEOM (2022a) reports that pearl products are the most important export of French Polynesia (53% of all exports by value), ahead of fish (19%), coconut oil (7%) and vanilla (6%).
- Covid had a large impact on the fishery exports of the territory. Most commodities suffered in 2020, but many (pearls, aquarium products, fresh tuna) bounced back in 2021.

## 21.4 Government revenue from fisheries

### Access fees for offshore fishing

In December 2000 all access agreements with foreign fishing fleets ceased (DRM 2022b). Consequently, no access fees for foreign fishing have been received since that time. There are no access fees for domestic vessels.

### Other government revenue from fisheries

In general, in French Polynesia the fisheries sector is not revenue generating, but rather is subsidy absorbing. A variety of subsidies are available for the various fisheries sub-sectors, such as for longline fuel and for the construction of coastal fishing vessels.

There is a small tax on the export of pearls. Initially, the rate of taxation was XPF 200 per gram, but in 2009 it was changed to XPF 50 per pearl. It was originally intended to finance pearl promotion work, but currently the proceeds go the territorial government's general fund. There are reports that the tax was relaxed during Covid.

## 21.5 Fisheries-related employment

DRM's Statistics Bulletin (DRM 2022a) is an excellent, comprehensive inventory of fisheries and aquaculture production in French Polynesia. By contrast, information on socioeconomic aspects of fisheries in the territory is more difficult to locate. The Bulletin indicates there were a total of 1,110 professional lagoon fishers in 2021 (i.e. those that were issued with a "carte professionnelle de pêcheur lagonaire").

The published report of the 2015 French Polynesia household income and expenditure survey (ISPF undated) does not contain information useful for estimating the number of people or households involved with fisheries.

The publication "Bilan de l'emploi en 2020" (ISPF 2021) states that the number of people employed in pearl culture declined 39%, with 590 employed people in 2020 compared to 960 people a year earlier. An older review of labour in French Polynesia by ISPF (2015b) states that the 2014 pearl culture workforce consisted of 1,060 employees. The "Bilan de l'emploi en 2020" also indicates that employment in fishing and freshwater aquaculture remained constant between 2019 and 2020.

The Pacific Community (SPC 2013) uses field survey data to examine the ratio of men to women fishers across the Pacific. For the French Polynesia sites examined, about 78% of fishers are men and 22% are women.

## 21.6 Levels of fishery resource consumption

Historical studies of fish consumption in French Polynesia are:

- Service de la Pêche analysed fish consumption in French Polynesia in 2003 (Service de la Pêche, unpublished data). Annual per capita fish consumption of 31.4 kg was determined by applying the following estimates: domestic fish production of 9,102 t, net weight; fish imports of 790 t; fish exports of 1,731 t; and a population of 259,596 people. This study reduced the domestic fisheries production ("live weight") by 30%. It is presumed that this was to obtain the actual food weight.
- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. For the whole of French Polynesia, the annual per capita fish consumption (whole weight equivalent) was 70.3 kg, of which 82% was fresh fish. Annual per capita consumption of fish was estimated to be 90.1 kg for rural areas and 52.2 kg for urban areas.

- A study by the Fisheries Centre of the University of British Columbia (Bale et al. 2009) examined various studies estimating fish consumption in French Polynesia and applied 2007 consumption rates to the various island groups: rural Tahiti (19.3 kg/person/year); Society Islands, except Tahiti (43.7 kg/person/year); Austral Islands (43.7 kg/person/year); Marquesas (21.9 kg/person/year); and Tuamotu/Gambier (150 kg/person/year).

Alvea Consulting (2021) is a study of many aspects of the marketing and consumption of fish in Tahiti. The report states that 789 t of lagoon fish are consumed by the households of Tahiti. This equates to an average of 73 kg (whole fish equivalent) per household and 20 kg per individual.

The results of the present study show the locally produced supply of fish (Table 21-11).

**Table 21-11:** Annual supply of fish from domestic sources

| Source | Tonnage for domestic consumption | Notes |
|---|---|---|
| Coastal commercial | 8,250 | Reduction from total harvest for non-edibles and the limited exports |
| Coastal subsistence | 2,350 | |
| Offshore locally based | 4,000 | 6,000 tonnes of production, with 1/3 exported in a normal (non-Covid) year |
| Freshwater | 100 | |
| Aquaculture | 176 | Shrimp: 161 tonnes<br>Batfish: 15 tonnes |
| **Total fish supply from domestic sources** | **14,876** | |

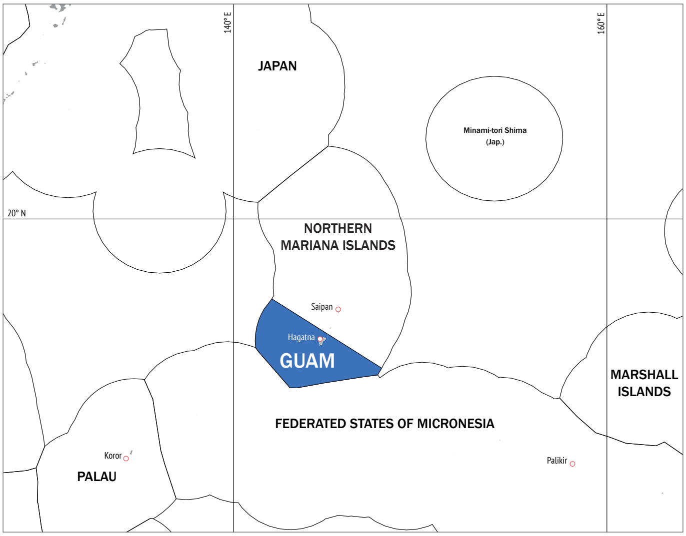
With a population of about 280,000, 14,876 t equates to 53 kg of fish (whole fish equivalent) per person per year. This does not consider imports of fish or tourist consumption of fish.

## 21.7 Exchange rates

The average yearly exchange rates (XPF to the US dollar) used in this book are as follows:

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 89.88 | 86.01 | 98.13 | 108.81 | 114.17 | 99.42 | 104.39 | 106.78 | 98.00 | 105.37 | 120.27 |

# 22 Guam




## 22.1 Volumes and values of fish harvests in Guam

### Coastal commercial catches in Guam

The dynamics and locations of Guam's major commercial fishing methods are given in Box 22-1.

**Box 22-1:** Some characteristics of Guam's main commercial fishing methods

Trolling represents most of the catch from boat-based fishing in Guam. The annual catch estimates at Agana and Agat are ~100,000 kg for non-charter trolling since surveys began in the 1980s and have increased in recent years. The annual catch from non-charter bottomfishing has decreased across ports over time. In recent years Agana appears to contribute the most bottomfish catch, with Agat and Merizo contributing similarly to each other. In the past 10 years, catch from unsampled ports accounts for 7% of the total catch for trolling and 9% of the total catch for bottomfishing. The catch from "atulai night light" fishing method decreases substantially around the year 2000, though the catch has rebounded slightly since 2010. For spearfishing/scuba, pulses of high catch (> 20,000 kg) occur in several years at Agat, with the high catch in 1996 and 2000 coinciding with the highest fishing effort. The catch from spearfishing/snorkel is of the same order. For gillnet, the catch is often the highest at Merizo.

Source: Ma et al. (2022)

There have been three major attempts to estimate the production of coastal commercial fishing across the Pacific Island region that have included Guam. The following describe the results of those studies that deal with coastal commercial fisheries of Guam:

- Dalzell et al. (1996) used information in two annual statistical summaries from the Western Pacific Fisheries Information Network (WPacFIN)[1] to estimate an annual coastal commercial fishery production in Guam in the early 1990s of 118 tonnes (t).
- Gillett (2009a) used information from WPacFIN and other sources to estimate that the 2007 production from coastal commercial fishing in Guam was 44 t, worth US$195,000 to fishers.
- Gillett (2016) used similar information sources as the above point to estimate that the 2014 production from coastal commercial fishing in Guam was 72 t, worth US$388,996 to fishers. This production was relatively large compared to that of Gillett (2009a) and was attributed to low production in 2007 due to a spike in the cost of fuel.

Since the above studies, there have been a number of changes to Guam's fisheries. These include:

- In the early 2010s export-oriented fishers from Micronesian countries (especially Chuuk in the Federated States of Micronesia) experienced a large increase in air freight rates to send fish to Guam. Many fishers reacted by moving their fishing operations to Guam, increasing the fishing effort in Guam.
- Scuba fishing, including scuba spearfishing, was banned in Guam in 2020.
- The ban on scuba fishing was one factor leading to the demise of the aquarium products fishery.
- In the Covid period of 2020 and 2021, fish markets were closed and there were restrictions on shore fishing. Boats could still fish in the ocean, but due to closed fish markets, catch disposal was a problem – so informal markets developed.

Guam focuses considerable attention on coastal commercial fisheries statistics.

[1] Established in 1981, the Western Pacific Fisheries Information Network (WPacFIN) is a cooperative programme involving the WPacFIN Central office at the Pacific Islands Fisheries Science Center and participating fisheries agencies in American Samoa, the Commonwealth of the Northern Mariana Islands, Guam and Hawaii. WPacFIN helps its partner agencies consolidate, summarise, and provide access to the available fisheries data to meet the needs of fishery managers, scientists and fishermen.

A recent report by the Western Pacific Regional Fisheries Management Council (WPRFMC 2022b) states that Guam currently has three fishery-dependent collection programmes which can be described as long-term data collection programmes with different approaches for gathering important information on fishery harvest methods performed by fishermen. The programmes include the shore-based and boat-based data programmes and the commercial fishery programme. The Sportfish Restoration Grant from the U.S. Fish and Wildlife Service provides a significant portion of the funding for these programmes. Training of fishery staff to collect information is rigorous, and year-end totals are calculated by an expansion process done in collaboration with the U.S. National Marine Fisheries Service.

In Guam (as in American Samoa and the Northern Mariana Islands), there is no shortage of fishery surveys and associated results – but trying to use that data to estimate total fishery production is not straightforward.

The WPacFIN data portal of the National Oceanic and Atmospheric Administration (NOAA) Fisheries website has a data query function from which it is possible to obtain "total fish catches by island area". One of the options is "WPacFIN's Best Estimated Total Commercial Landings" for Guam. The website gives an explanation for the option:

> "WPacFIN's Best Estimated Total Commercial Landings uses integrated data from multiple sources, with interpretation based on elements such as conversion factors from processed to estimated whole weight and reconciliation of differences between data sources."

Using that information, it is possible to construct Table 22-1 below.

**Table 22-1:** The "Best Estimated Total Commercial Landings" of Guam from WPacFIN

| | Estimated commercial weight (pounds) | Estimated commercial weight (kg) | Estimated commercial value (US$) |
|---|---|---|---|
| 2016 | 154,538 | 70,083 | 380,121 |
| 2017 | 343,762 | 155,896 | 869,622 |
| 2018 | 214,527 | 97,288 | 582,288 |
| 2019 | 200,904 | 91,110 | 506,899 |
| 2020 | 103,703 | 47,029 | 295,035 |
| 2021 | 56,614 | 25,674 | 150,959 |

There are some reservations about the information in the table. These include reduced inshore fisheries collection during the Covid period (BSP 2021) and low coverage of some of the newer fish markets. Despite these shortcomings, no better information on recent commercial landings exists. The present study will therefore assume that WPacFIN's "Best Estimated Total Commercial Landings" (i.e. Table 22-1 above) are a reasonably accurate assessment of total commercial fish landings in Guam.

By using Table 22-1 above (The "Best Estimated Total Commercial Landings" of Guam), it is possible to divide the commercial value by the weight to obtain the average price per pound for the entire commercial catch each year (Table 22-2).

**Table 22-2:** Price of fish received by fishers

| | Price per pound (US$) | Price per kg (US$) |
|---|---|---|
| 2016 | 2.46 | 5.42 |
| 2017 | 2.53 | 5.58 |
| 2018 | 2.71 | 5.99 |
| 2019 | 2.52 | 5.56 |
| 2020 | 2.84 | 6.27 |
| 2021 | 2.67 | 5.88 |

From the information above, the estimated total coastal commercial catch on Guam in 2021 is 25.7 t, worth US$150,959 to fishers.

## Coastal subsistence catches

The degree of economic development in Guam is very high relative to most Pacific Island countries and territories. This could partially explain why dividing coastal fishing activity into commercial and subsistence components is more difficult in Guam than elsewhere in the region. Zeller et al. (2007) state that because there are few full-time commercial fishers, there is little distinction between commercial, subsistence and recreational fishing, and many fishing trips contribute to all three segments.

Some of the estimates of production from Guam's coastal subsistence fisheries have been:

- Dalzell et al. (1996) estimated an annual subsistence catch for Guam in the early 1990s of 472 t.
- Gillett (2009a) estimated subsistence production in 2007 of 70 t, worth US$217,000 to fishers.
- Gillett (2016) estimated a coastal subsistence production of about 42 t, worth about US$158,358 to fishers.

With the reasonably accurate estimate of the production from coastal commercial fisheries in the section above, one way to approach the more difficult task of estimating coastal subsistence production is by the subsistence/commercial ratio:

- Van Beukering (2007) gives the results of a household survey of 400 local residents aimed at determining the nature and level of the value of Guam's coral reefs. The report states that about 40% of the fish and other seafood consumed by the respondents came from non-commercial fishers.
- According to staff of the Division of Aquatic and Wildlife Resources, the subsistence/commercial ratio is about 30/70 (J. Gutierrez and B. Tibbatts, per. com. September 2015).
- According to staff of the Division of Aquatic and Wildlife Resources, the proportion harvested by subsistence fishers increased during Covid (B. Tibbatts, M. Duenas and T.Flores, per. com. November 2022).

The readily available information is inadequate for estimating recent production from coastal subsistence fisheries. An educated guess of the production in 2021 is about 30 t. Using the farm gate approach to valuing subsistence production (i.e. reducing the coastal commercial price by 30%), the subsistence production in 2021 was worth about US$176,400 to fishers.

### Locally based offshore catches

In 2021 there was no locally based offshore fishing in Guam.

### Foreign-based offshore catches

There was no authorised foreign fishing in Guam's zone in 2021. U.S. vessels are not considered to be foreign.

### Freshwater catches

According to staff of the Division of Aquatics and Wildlife Resources, a small amount of eels and *Macrobrachium* are captured in Guam's streams, plus a somewhat larger amount of tilapia in ponds and in the Masso Reservoir (J. Gutierrez, per. com. October 2008).

As reported in the brochure "Native Freshwater Fauna of Guam" (DAWR undated), there are 13 species of finfish, crustaceans and molluscs of importance in Guam.

Statistics are not collected on the production from freshwater fishing activities. For the purposes of the present study, it is assumed that in 2014 the production from freshwater fishing was 3 t, worth US$12,000.

## Aquaculture harvests

The report of the 2017 Agriculture Census of Guam (NASS 2020) is ambiguous on aquaculture. It states in two sections there were six aquaculture farms on Guam in 2017, and in two other sections that there was one aquaculture farm on Guam in 2017. Production information is not given.

According to staff of the Division of Aquatic and Wildlife Resources, (a) current aquaculture is mainly tilapia, with a smaller amount of shrimp, perhaps 2 to 3 tonnes; and (b) the amount of aquaculture production in Gillett (2016) seems too high (B. Tibbatts, M. Duenas and T. Flores, per. com. November 2022).

A Sea Grant programme officer stated that (a) he is aware of a survey in 2018 that estimated about 220,000 pounds (99.7 tonnes) of tilapia was produced in that year, (b) the current farm gate price of tilapia on Guam is US$4 per pound, and (c) not much besides tilapia is produced (D. Crisostomo, per. com. November 2022).

The above information is inadequate for making an estimate of the 2021 aquaculture production for Guam. Nevertheless, for the purposes of the present study, the production is deemed to be 100 t, with a farm gate value of US$433,000.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values of the fishery and aquaculture harvests in 2021 can be made (Table 22-3).

**Table 22-3:** Annual fisheries and aquaculture harvest in Guam in 2021

| Harvest sector | Volume (t) | Value (US$) |
|---|---|---|
| Coastal commercial | 25.7 | 150,959 |
| Coastal subsistence | 30 | 176,400 |
| Offshore locally based | 0 | 0 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 3 | 12,000 |
| Aquaculture | 100 | 433,000 |
| **Total** | **158.7** | **772,359** |

The estimates above are judged to be not very accurate, except perhaps for the estimate for the coastal commercial fisheries, which appears to be quite good relative to those estimates in this study from other Pacific Island countries and territories.

Figures 22-1 and 22-2 show the volumes and values of Guam fisheries production in 2021.

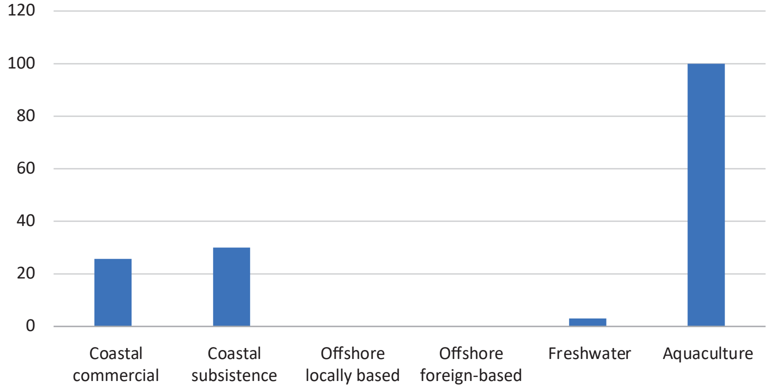



**Figure 22-1:** Guam fisheries and aquaculture production in 2021 by volume (t)

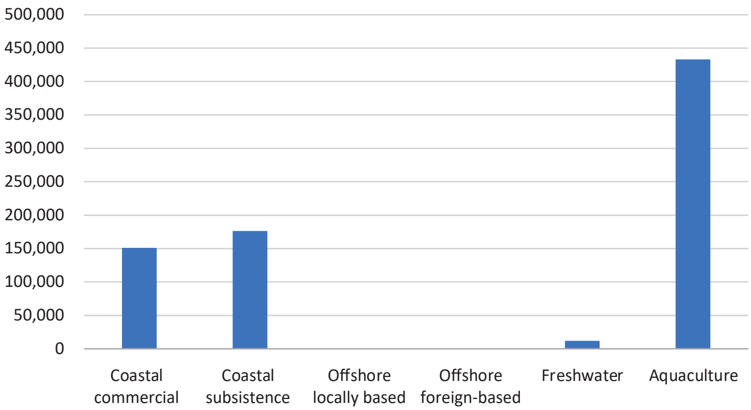



**Figure 22-2:** Guam fisheries and aquaculture production in 2021 by value (US$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for Guam from those studies are provided in Table 22-4.[2]

[2] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

**Table 22-4:** Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t) | Nominal value (US$) |
|---|---|---|---|
| Coastal commercial | 1999 | n/a | n/a |
| | 2007 | 44 | 195,000 |
| | 2014 | 72 | 388,996 |
| | 2021 | 25.7 | 150,959 |
| Coastal subsistence | 1999 | n/a | n/a |
| | 2007 | 70 | 217,000 |
| | 2014 | 42 | 158,358 |
| | 2021 | 30 | 176,400 |
| Offshore locally based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Offshore foreign-based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 3 | 10,000 |
| | 2014 | 3 | 11,000 |
| | 2021 | 3 | 12,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 162 | 948,000 |
| | 2014 | 100 | 800,000 |
| | 2021 | 100 | 433,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

## 22.2 Contribution of fishing to GDP

### Current official contribution

The Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce makes estimates of the GDP of Guam under the Statistical Improvement Program, funded by the Office of Insular Affairs of the U.S. Department of the Interior.

The BEA estimated that the GDP of Guam was US$5,886 million in 2020 and US$6,123 million in 2021. In the readily available documentation, there is no information on the fishing contribution to Guam's GDP.

## Method used to calculate the official fishing contribution to GDP

BEA (2021) states that estimates of current-dollar GDP for Guam, the Commonwealth of the Northern Mariana Islands (CNMI), American Samoa and the U.S. Virgin Islands are made using the expenditures approach, i.e. as the sum of goods and services sold to final users. It is calculated by summing personal consumption expenditures, private fixed investment, change in private inventories, net exports of goods and services, and government consumption expenditures and gross investment. No information is available on how BEA treats the fishing sector.

Officials of the Guam Bureau of Statistics and Plans are not certain whether the BEA GDP estimate for Guam considers the fishing sector (M. Guerrero, A. Trinidad and A. Pitter, per. com. November 2022).

## Estimate of fishing contribution to GDP

Table 22-5 (below) represents one option for estimating fishing contribution to the GDP of Guam. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 22.1 above (summarised in Table 22-3) and determines the value added by using value-added ratios (VARs) characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by use of specialised studies (Appendix 3).

**Table 22-5:** Fishing contribution to Guam GDP in 2021

| Harvest sector | Gross value of production (US$, from Table 22-3) | VAR | Value added (US$) |
|---|---|---|---|
| Coastal commercial | 150,959 | 0.60 | 90,575 |
| Coastal subsistence | 176,400 | 0.75 | 132,300 |
| Offshore locally based | 0 | 0 | 0 |
| Freshwater | 12,000 | 0.85 | 10,200 |
| Aquaculture | 433,000 | 0.65 | 281,450 |
| **Total** | **772,359** | --- | **514,525** |

The contribution of fishing to GDP in 2021 estimated in the table (US$514,525) represents about 0.01% of the US$6,123 million GDP of Guam for 2021.

## 22.3 Exports of fishery production

Given that Guam has a large amount of tourism and military activity and a small fisheries sector, the fishery exports of Guam have limited economic importance. Determining the precise quantity is difficult because sometimes bona fide fisheries exports are aggregated in the statistics with the transshipped catch of foreign longliners that make port calls in Guam.

The quarterly trade reports of Guam's Bureau of Statistics and Plans indicates that in 2021 a total of US$78,118 of "Fish; Fresh, Frozen or Chilled" was exported from Guam. This equates to about 0.04% of all of Guam's exports for that year.

## 22.4 Government revenue from fisheries

### Access fees for offshore fishing

There is currently no authorised foreign fishing in the Guam zone, and therefore no access fees are paid by foreign vessels. United States vessels are considered to be domestic vessels. There are no access fees for domestic vessels.

### Other government revenue from fisheries

Any fishing licensing fees paid by vessels based in Guam go to U.S. government agencies, rather than to the Government of Guam.

## 22.5 Fisheries-related employment

There is very little new information on fisheries-related employment in Guam. Some of the historical studies are:

- Van Beukering (2007) gives the results of a household survey covering 400 local residents aimed at determining the nature and level of the value of Guam's coral reefs. The report states that approximately 40% of local residents fish on a regular basis, which was identified to be more important as a social activity than as an income-generating activity.
- In August 2008 Guam's Bureau of Statistics and Plans forwarded the following fisheries-related employment information to the Food and Agriculture Organization (FAO) for the calendar year 2007: 1,565 full-time fishers, 60 part-time fishers and 170 occasional fishers.
- Allen and Bartram (2008), citing a number of studies, show that the Guam Fishermen's Cooperative membership includes 164 full-time and

part-time fishers, and it processes and markets an estimated 80% of the local commercial catch. Although in some cases commercial fishing contributes substantially to household income, nearly all Guam domestic fishers hold jobs outside the fishery. Domestic fishing in Guam supplements family subsistence, which is gained by a combination of small-scale gardening, ranching and wage work.

- A community awareness study carried out for the Guam Coastal Management Program covered participation in fisheries (Glimpses Advertising 2012). The results indicated that 49% of Guam's population reported participation in fisheries in 2011.

There is not much new and relevant information on fisheries-related employment in Guam. The readily available data appears to be limited to:

- The "Current Employment Report" of Guam's Department of Labor is of limited use in determining the importance of fisheries-related employment. The most detailed disaggregation in that report is the category "agriculture" (which includes fisheries). In December 2021 there were 310 private sector agriculture workers, of which 50 were women.
- The U.S. Bureau of Labor Statistics has a website for "May 2021 State Occupational Employment and Wage Estimates Guam", which shows that 60 people were employed in "Farming, Fishing, and Forestry Occupations".
- The 2020 Guam Statistical Yearbook (BSP 2021) shows 200 people employed in "Farming, Fishing, and Forestry Occupations" in May 2020.

## 22.6 Levels of fishery resource consumption

Several older studies provide information on per capita fish consumption, summarised below:

- Gillett and Preston (1997) estimated that the production from coastal fisheries (commercial and subsistence) in Guam in the early 1990s represented an annual per capita fish supply of 4.4 kg.
- Van Beukering (2007) shows that most households consume fish approximately twice a week. This has not changed a great deal in the last decade. However, presently more than half of all consumed fish comes from stores or restaurants, while around 40% comes from immediate or extended family, or friends.
- Zeller et al. (2007) indicate that seafood imports in 2002 were 20.9 kg/person.

- Allen and Bartram (2008) cite Amesbury (2006), which states that annual seafood consumption in Guam is estimated to be about 60 lbs (27.2 kg) per capita.
- The Development Plan for Aquaculture on Guam (Brown et al. 2010) indicates that the total annual seafood supply obtained is about 8 million pounds (3,624 t), and per capita consumption is about 45 pounds (20.4 kg) per year, which, given the crudeness of the methods used, is not significantly different from a previous estimate of 60 pounds (27.2 kg) per year given by a 2006 survey (J. Amesbury 2006, cited in Allen and Bartram 2008).
- A study of market forces and nearshore fisheries management in Micronesia (Rhodes et al. 2011) states that in Guam, consumption rates – which include total fish imports, plus reported catches from commercial non-pelagic landings and creel survey landings converted to a per capita basis – for the period 1985–2002 range from 21.7 to 22.6 kg per year, which is similar to findings for reef fish consumption in other recent studies.

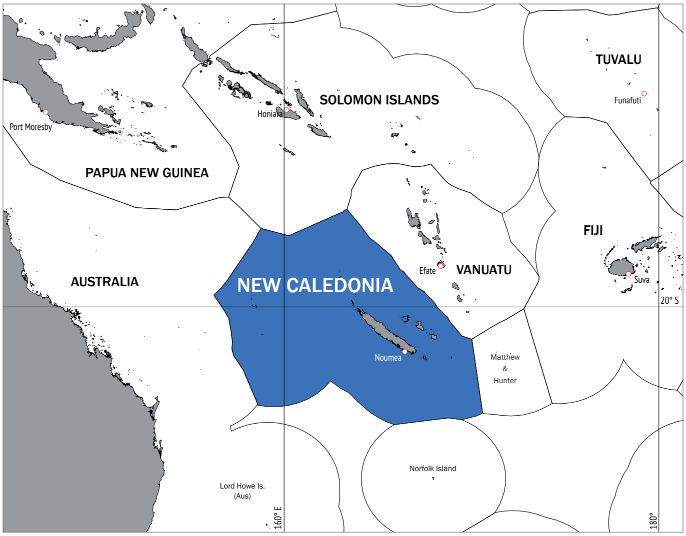
The only new and readily available information on fish consumption on Guam are the advisories issued by the Guam Department of Public Health and Social Services to avoid consuming fish in certain areas. As an example:

> Cocos Lagoon: A fish consumption advisory for Cocos Lagoon has been in effect since 2006. The advisory stems from fish tissue sampling conducted by the U.S. Coast Guard that indicated levels of polychlorinated biphenyls above U.S. EPA recommended screening value for those fishing in recreational waters. The advisory only applies to consuming fish and does not cover swimming, wading or other recreational activities in the lagoon. PCB contamination in the Lagoon along the Cocos Island shoreline is suspected to have come from the former U.S. Coast Guard Long Range Navigation station on Cocos Island.

## 22.7 Exchange rates

Guam uses the US dollar (US$).

# 23 New Caledonia




## 23.1 Volumes and values of fish harvests in New Caledonia

### Coastal commercial catches in New Caledonia

The marine fisheries of New Caledonia are divided into three categories:

- Lagoon fishing is carried out inside the reef by using small boats or without boats.
- Coastal fishing occurs outside the lagoon up to a distance of 22 km seaward of the reef.
- Offshore fishing is carried out in the exclusive economic zone.

Categories #1 and #2 above are considered "coastal fishing" in the present study.

The participants in lagoon and coastal fisheries of New Caledonia are divided into two categories:

- Professional fishers: fishing is their work; they have authorisations to fish from their provinces, and they enjoy a variety of government subsidies.
- Non-professional fishers: fishing is not their work; they fish for pleasure or for providing food for their households.

The following summarise some of the historical attempts to estimate coastal fisheries production in New Caledonia:

- Dalzell et al. (1996) used the official New Caledonia catch statistics for 1992 and 1993 to estimate a coastal commercial fisheries production of 981 tonnes (t), worth US$3,968,650, and a coastal subsistence catch of 2,500 t, worth US$9,000,000.
- Dupont et al. (2004) estimated annual production for 2002 and 2003: (a) lagoon and coastal commercial fishing: 1,200 t, 238 fishing vessels, 492 fishers; and (b) fishing for home consumption (subsistence and recreational): 3,500 t.
- Gillett (2009a) considered the Dupont et al. estimate, the declared production of New Caledonia reef/lagoon fisheries from professional fishers in 2006 and 2007, and published fish prices for 2006. The study estimated that in 2007: (a) the coastal commercial fisheries production was 1,350 t, worth XPF 756 million (Pacific Franc Exchange) at the point of first sale; and (b) the subsistence coastal fisheries production was 3,500 t, worth XPF 1,372 million to fishers.
- Gillett (2016) considered the recent sources of information coastal fisheries production in New Caledonia and concluded that the most appropriate approach for estimating total production was to assume no change in the volume of coastal fisheries production since the Gillett (2009a) study but a 21% increase in the value. Accordingly, the study estimated that the coastal commercial fisheries production was 1,350 t, worth XPF 915,000,000 at the point of first sale.

New Caledonia's Coastal Fisheries Observatory produces an annual report of activities that contains a considerable amount of useful information on coastal commercial fishing. The two most recent annual reports were used to construct Table 23-1.

**Table 23-1:** Summary details of coastal commercial fishing

| | 2019 | 2020 |
|---|---|---|
| Number of professional fishers | 601 | 543 |
| Number of coastal fishing boats | 503 | 459 |
| Declared catch in tonnes | 939 | 837 |
| Sales revenue in XPF | 600,000,000 | 598,000,000 |
| Sales revenue per kg of catch | 639 | 913 [1] |

Source: OPC (2021), OPC (2022)

[1] The sales revenue divided by the declared catch for 2020 equals 714 XFP per kg, which is different from the 913 XFP given in the table. The sales revenue divided by the declared catch for 2019 equals 639 XFP, which is the same as that given in the table. In the present study, 714 XFP will be used as the sales revenue per kg of catch in 2020 – and will be used for projecting the value of fish catches in 2021.

Between the two years, the number of professional fishers and coastal fishing boats declined, but the sales revenue per kg increased considerably, with the impacts of Covid presumably a major factor in the changes.

More details on the catch are given in Table 23-2. It is evident that in 2020 finfish were responsible for 65% of the catch.

**Table 23-2:** Composition of the coastal commercial catch (t)

| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| Lagoon and reef finfish | 450 | 466 | nd | nd | 545 | 522 | 545 |
| Trochus shells | 127 | 146 | nd | nd | 14 | 7 | 8 |
| Sea cucumber (dry weight) | 52 | 45 | nd | nd | 46 | 37 | 21 |
| Crustaceans | 62 | 63 | nd | nd | 78 | 90 | 82 |
| Molluscs | 9 | 9 | nd | nd | 10 | 18 | 14 |
| **Total lagoon and reef** | **699** | **730** | **nd** | **nd** | **693** | **674** | **670** |

Source: Unpublished data, Service de la Marine Marchande et des Pêches Maritime; nd = no data

Extrapolating the declared commercial production to obtain all of the commercial production is difficult. In discussions with fisheries officials and other fishery stakeholders in New Caledonia, it was not possible to obtain even an estimate of the non-declared production. It should be noted that the numerous subsidies enjoyed by professional fishers provide a considerable incentive to be registered as a professional and declare catches. For lack of an alternative, the present study assumes that the declared commercial production is equal to all commercial production.

2020 is the latest year for which there is production data for New Caledonia's coastal commercial fisheries. To estimate the production for 2021 (the focus year of the present study), the impacts of Covid must be considered. The head of the Southern Province's Fisheries Bureau expressed the opinion that the volume of the 2021 coastal commercial catch was not remarkably different from that of 2020, but the price of fish increased (B. Fao, per. com. September 2022). For the purposes of the present study, it will be assumed that the price of fish to the fisher increased 8% between 2020 and 2021 (i.e. 771 XPF per kg in 2021).

Following from the above information, the volume of coastal commercial fishery production in 2021 is estimated to be 680 t, worth 524,280,000 XPF to the fishers.

## Coastal subsistence catches

For the purposes of this study, the catches from recreational fishing are considered as production for home consumption and therefore as a component of subsistence fisheries.

The 2021 annual report of the Coastal Fisheries Observatory (OPC 2022) states that the lagoon catches of the non-professional fishers supply 85% of all the lagoon fish consumed in New Caledonia. It should be noted that the "non-professional lagoon catches" are similar but different to the "coastal subsistence catches" of the present study. Accordingly, the coastal subsistence catches of New Caledonia in 2021 are estimated to be about 4,760 t. By using the farm gate method for valuing subsistence production, this is estimated to be worth 2,568,972,000 XPF to the fishers.

## Locally based offshore catches

There appears to be very good data available on the catches of New Caledonia-based offshore fishing vessels (Table 23-3). This is because the fleet is monitored by an electronic vessel monitoring system, onboard observers, vessel logsheet information and catch offloading.

New Caledonia's annual report to the Scientific Committee of the Western and Central Pacific Fisheries Commission (Anon. 2022b) states:

> The development of the domestic longline fleet started in 1983 and the early 2000s saw a significant increase in the number of longline vessels. However, from 2003 onwards, the lack of skilled manpower led to an under-utilisation of the vessels and several fishing companies stopped their activity. The number of fishing vessels continued to decrease gradually until 2013, when the fleet stabilised at around 6 to 7 fishing companies and 16 to 18 active longliners per year. In 2021, 18 licensed domestic longliners were active. However, one of them had to stop its activity because of its obsolescence. All active vessels in 2021 are less than 200 gross registered tons GRT. The larger longliners nearing 150 tons can stay at sea for two or more weeks. Fishing campaigns last on average 12 days and fishing activity lasts on average 8 days. 347 fishing trips were reported in 2021, totalling 4,120 days at sea.

Table 23-3: Locally based offshore catches (t)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Albacore | 1,734 | 1,752 | 1,965 | 1,903 | 1,774 |
| Yellowfin | 559 | 467 | 664 | 515 | 624 |
| Bigeye | 48 | 46 | 37 | 51 | 59 |
| Black marlin | 65 | 28 | 29 | 32 | 34 |
| Blue marlin | 34 | 13 | 11 | 10 | 16 |
| Pacific bluefin tuna | 1 | 1 | 1 | 0 | 0 |
| Skipjack | 41 | 15 | 11 | 8 | 11 |
| Striped marlin | 77 | 52 | 84 | 81 | 97 |
| Swordfish | 22 | 8 | 8 | 9 | 10 |
| **Total catch (t)** | **2,581** | **2,382** | **2,810** | **2,609** | **2,626** |

Source: Adapted from Anon. (2022a)

There is only a limited amount information readily available on the value of New Caledonia's offshore catch.

- In New Caledonia's annual report to the Scientific Committee of the Western and Central Pacific Fisheries Commission (Anon. 2022a), there is the statement that the gross income of the New Caledonia long-line fleet was around 1 billion XPF, and it is expected that the results for 2021 are better due to the increase of production.
- The Forum Fisheries Agency (FFA) each year makes estimates for the volume and value of tuna catches for all countries involved in industrial tuna fishing in the central and western Pacific Ocean. FFA (2022b) indicates that the tuna catch of the New Caledonia longline fleet in 2021 was $10,833,473 (XPF 1,141,523,050). This is similar to the estimate given in Anon. (2022a) above.
- An SPC master fisherman with substantial experience in longlining in New Caledonia gives his estimates of longline fish prices "off the boat": albacore 600 XPF/kg, yellowfin 1000 XPF/kg and bigeye 1400 XPF/kg (W. Sokimi, per. com. February 2023).

For the purposes of the present study, the catch of the New Caledonia-based offshore fishing fleet will be taken as 2,625 t, worth XPF 1,846 million.

## Foreign-based offshore catches

Since 2001, when the last Franco-Japanese agreements were signed, there have been no foreign vessels licensed or chartered to operate in the New Caledonia exclusive economic zone (Anon. 2022b).

## Freshwater catches

Little information is available on freshwater fishing in New Caledonia. An official of Direction des Affaires Maritimes indicated that all such catches are for subsistence purposes and consist mainly of eels, *Macrobrachium* and some small species of finfish (R. Etaix-Bonnin, per. com. August 2008). A fisheries official of Province Sud indicated that there are catches of black bass from the lake in Yate (T. Tiburzio, per. com. September 2022).

A crude estimate of the annual harvest would be about 10 t. Valuing this production similarly as with the production of coastal subsistence fisheries production above, the 10 t would be worth XPF 5,397,000.

## Aquaculture production

A recent regional review of aquaculture in Pacific Island countries (IAS 2022) comments on aquaculture in New Caledonia:

- Current species cultivated commercially: Blue shrimp (*Litopenaeus stylirostris*) Approx 2000 tonnes per year. Mostly exported. Native rock oyster (*Saccostrea cucullate*) 12,000 dozen produced/year for local market. Wild spat collection. Small-scale aquarium trade: Fish (species depending on collection), clams (mainly Tridacnids), soft corals (mainly *Sarcophyton* spp. and Sinularia spp.) and the coral sea seahorse (*Hippocampus semispinosus*). World Bank gives production in 2018 as 1716 tonnes (presumably mostly prawn).
- Current species used for food security and small-scale community-based production: None
- Other species attempted: Sea cucumber (*Holothuria scabra*) in prawn ponds. Not commercial yet.
- Future strategy and directions planned: Fish: 'Pouatte' (Emperor red snapper), 'Picot rayé' (Golden-lined spinefoot, *Siganus lineatus*), 'Picot gris' (Mottled spinefoot, *Siganus fuscescens*).

Aquaculture in New Caledonia is dominated by shrimp farming. Over the last decade, the annual production fluctuated around 1,500 t from about 650 hectares of ponds. The most important market is New Caledonia (about 46% of the production), followed by Japan (39%) (IEOM 2019).

An official of New Caledonia's Agence Rurale has indicated that shrimp production in New Caledonia was 1,472 tonnes in 2020 and 1,470 tonnes in 2021. The revenue at first sale in 2020 was XPF 1,949,000,000 (XPF 1,324 per kg), with the 2021 sales revenue not yet available (V. Roussery, per. com. September 2022).

Other data on aquaculture production in New Caledonia is scarce. The readily available information includes:

- For gigas oysters, there is little information on volumes or value produced other than IAS (2020) above, which mentions 12,000 dozen produced per year, and unpublished data from Service de la Marine Marchande et des Pêches Maritimes showing about 70 tonnes of oysters produced annually in the years 2007–2011, with no data after that year.
- The document "Pêches Professionnelles Maritimes et Aquaculture 2016–2018" (DAM 2019) indicates that the total production of aquaculture in the territory in 2018 was 1,517 tonnes, including 12 tonnes of "pouattes" (emperor red snapper). For all aquaculture in New Caledonia, the revenue at first sale in 2018 was XPF 1,854,000,000. The average price at first sale for all aquaculture production was XPF 1,156 per kg.
- Gillett (2016) estimated that for 2014, the annual production of freshwater crayfish was between 3 to 4 t, and for gigas oysters between 40 and 80 t (DAM unpublished data). The price at first sale for both commodities in 2014 was estimated to be XPF 90 million.
- Small amounts of cultured siganids and tilapia have been mentioned by various government officials.

The above information is inadequate for estimating the production of aquaculture in 2021. Apart from the data for shrimp culture, readily available production information on the other aquaculture commodities is scarce.

A crude approximation of the aquaculture production in 2021 is about 1,538 t (i.e. 1,470 t of shrimp and 68 t of other), with a farm gate value of XPF 2,088,000,000.

## Summary of harvests

A crude approximation of the annual volumes and values at point of first sale of the fisheries and aquaculture harvest in New Caledonia in 2021 is given in Table 23-4.

**Table 23-4:** Annual fisheries and aquaculture harvest in New Caledonia in 2021

| Harvest sector | Volume (t) | Value (XPF) |
|---|---|---|
| Coastal commercial | 680 | 524,280,000 |
| Coastal subsistence | 4,760 | 2,568,972,000 |
| Offshore locally based | 2,625 | 1,846,000,000 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 10 | 5,397,000 |
| Aquaculture | 1,538 | 2,088,000,000 |
| **Total** | **9,613** | **7,032,649,000** |

Figures 23-1 and 23-2 show the volumes and values of New Caledonia fisheries and aquaculture production in 2021.

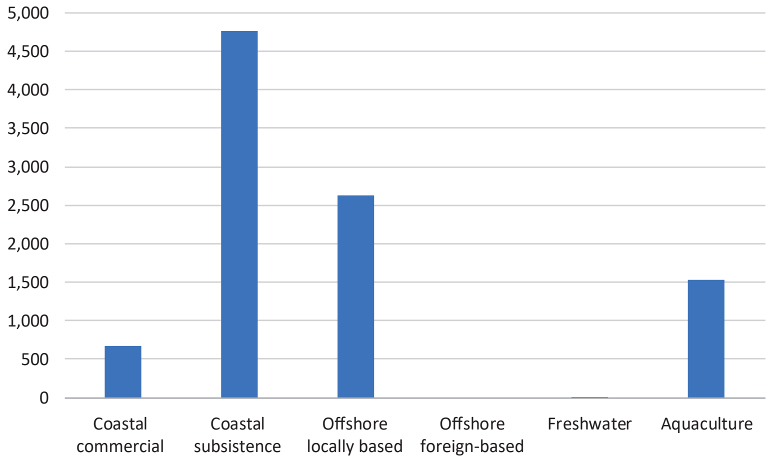



**Figure 23-1:** New Caledonia fisheries and aquaculture production in 2021 by volume (t)

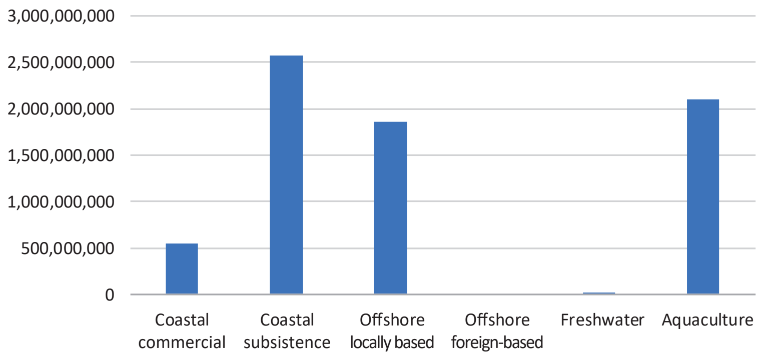



**Figure 23-2:** New Caledonia fisheries and aquaculture production in 2021 by value (XPF)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The estimated fishery production levels for New Caledonia from those studies are presented in Table 23-5.[2]

[2] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 23-5: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t) | Nominal value (XPF) |
|---|---|---|---|
| Coastal commercial | 1999 | n/a | n/a |
| | 2007 | 1,350 | 756,000,000 |
| | 2014 | 1,350 | 915,000,000 |
| | 2021 | 680 | 524,280,000 |
| Coastal subsistence | 1999 | n/a | n/a |
| | 2007 | 3,500 | 1,372,000,000 |
| | 2014 | 3,500 | 1,660,000,000 |
| | 2021 | 4,760 | 2,568,972,000 |
| Offshore locally based | 1999 | n/a | n/a |
| | 2007 | 2,122 | 745,000,000 |
| | 2014 | 2,876 | 1 316 600 000 |
| | 2021 | 2,625 | 1,846,000,000 |
| Offshore foreign-based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 10 | 3,992,000 |
| | 2014 | 10 | 4,743,000 |
| | 2021 | 10 | 5,397,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 1,931 | 1,443,700,000 |
| | 2014 | 1,733 | 1,843,500,000 |
| | 2021 | 1,538 | 2,088,000,000 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an improvement). In the table above the volumes of production for coastal commercial, coastal subsistence and freshwater do not change much between some of the years because there are no new production data and no anecdotal information suggesting changes. The change in coastal subsistence production between 2014 and 2021 represents a change in methodology (i.e. new surveys), rather than a real change in production. In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better-quality data) reflect real changes in the amounts being harvested.

## 23.2 Contribution of fishing to GDP

### Current official contribution

2017 is the latest year for which GDP information with details for the fishing sector is available. According to unpublished data from Institut de la statistique et des études économiques (ISEE), for that year:

- The value of the production of the fishing sector was XPF 6,317,000,000.
- The intermediate consumption for the sector was XPF 4,197,000,000.
- The value added (i.e. contribution of the sector to GDP) was therefore 2,120,000,000.
- With a 2017 GDP of XPF 862,551,000,000, the fishing sector contribution was 0.2% of GDP (i.e. 2,120/862,551).

### Method used to calculate the official fishing contribution to GDP

From information from ISEE (E. Desmazures, per. com. January 2023), it is understood that the methodology consists of:

- For shrimp aquaculture and offshore fishing, the details of production and value added are well known from company financial records.
- For professional fishing and non-professional fishing, data from Gillett (2009a) and other studies are used.

The data in the above two points are used according to the four steps given in the section above.

### Alternative estimate of fishing contribution to GDP

Table 23-6 (below) represents an alternative to the official method of estimating fishing contribution to GDP in New Caledonia. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 23.1 above (summarised in Table 23-4) and determines the value added by using value-added ratios

(VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

**Table 23-6:** Fishing contribution to GDP in 2021 using an alternative approach

| Harvest sector | Gross value of production (XPF, from Table 23-4) | VAR | Value added (XPF) |
|---|---|---|---|
| Coastal commercial | 524,280,000 | 0.65 | 340,782,000 |
| Coastal subsistence | 2,568,972,000 | 0.80 | 2,055,177,600 |
| Offshore locally based | 1,846,000,000 | 0.20 | 369,200,000 |
| Freshwater | 5,397,000 | 0.90 | 4,857,300 |
| Aquaculture | 2,088,000,000 | 0.40 | 835,200,000 |
| **Total (XPF)** | **7,032,649,000** | --- | **3,605,216,900** |

Source: Table 23-4 and consultant's estimate

It is not intended that the approach in Table 23-6 replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

New Caledonia's GDP was XPF 1,016 billion in 2021 (ISEE website). In 2021 fishing and aquaculture contribution to GDP (given in the table above) represents 0.36 % of the GDP of New Caledonia.

It is not appropriate to compare the 2021 fishing portion of GDP calculated in the present study (0.35%) to the 2017 official fishing contribution given in the section above (0.2%). However, it should be noted that the likely source of the large difference is in the value-added ratios (VARs). The 2017 overall VAR for the entire fishing sector is 0.33 (2,120/6,317). In the table above for the present study, the 2021 overall VAR for the entire fishing sector is 3.605 divided by 7.032 (i.e. 0.51). As ISEE has access to the company accounts for businesses involved in offshore fishing and shrimp aquaculture, the difference between the fishing GDP contribution of the present study and the official contribution is likely to come from the VARs of professional and non-professional coastal fishing.

## 23.3 Exports of fishery production

ISEE tracks New Caledonian exports, including fishery exports. The data are illustrated by volume in Table 23-7 and by value in Table 23-8.

**Table 23-7:** Fisheries exports of New Caledonia by volume (t)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Fishery and aquaculture products | 1,326 | 1,262 | 1,343 | 1,446 | 1,342 | 1,150 |
| Tuna | 418 | 407 | 391 | 477 | 407 | 525 |
| Shrimp | 807 | 770 | 797 | 887 | 878 | 566 |
| Sea cucumber | nd | 66 | 46 | 37 | 21 | 13 |
| Trochus shells | 88 | 10 | 85 | 18 | 18 | 18 |
| Other fisheries/aquaculture | 14 | 9 | 24 | 27 | 18 | 28 |
| Total exports of New Caledonia | 5,821,433 | 6,663,944 | 7,080,537 | 7,581,333 | 8,774,455 | 8,272,208 |
| Fishery and aquaculture products as a % of all exports | 0.02% | 0.02% | 0.02% | 0.02% | 0.02% | 0.01% |

Source: Adapted from ISEE website Units: Tonnes

**Table 23-8:** Fisheries exports of New Caledonia by value (millions of XPF)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Fishery and aquaculture products | 1,569 | 1,939 | 1,949 | 2,067 | 1,897 | 1,313 |
| Tuna | 221 | 197 | 189 | 260 | 225 | 270 |
| Shrimp | 1,297 | 1,244 | 1,305 | 1,434 | 1,459 | 878 |
| Sea cucumber | nd | 491 | 405 | 335 | 200 | 139 |
| Trochus shells | 42 | 5 | 32 | 8 | 6 | 8 |
| Other fisheries/aquaculture | 8 | 3 | 11 | 31 | 7 | 18 |
| Total exports of New Caledonia | 144,447 | 167,108 | 196,527 | 182,255 | 180,367 | 185,894 |
| Fishery and aquaculture products as a % of all export | 1.1% | 1.2% | 1.0% | 1.1% | 1% | 0.7% |

Source: Adapted from ISEE website Units: Millions of XPF

The low percentage by volume of the fishery exports is because New Caledonia exports huge amounts of relatively low-value nickel products.

It can be seen from the above tables that shrimp is by far the most important fishery export of the country, and that the exports of that commodity had been fairly steady until 2021 when Covid reduced global demand. Historically, the second-most important fishery export has been sea cucumber, but since 2020 it has slipped down to the third rank, behind tuna.

Unlike other Pacific Island countries or territories that have locally based longliners, most of the offshore catch in New Caledonia is not exported but is consumed domestically. About 80% of the offshore catch in 2021 was for the domestic market (Anon. 2022b). Almost half of the cultured shrimp is consumed domestically (IEOM 2019).

Table 23-9 from Anon. (2022) gives details on the disposal the longline catch in 2020, the latest year for which economic data is currently available.

**Table 23-9:** Destination of the offshore fishery production in 2020

| | Tuna | | | Billfish | | | Other | | |
|---|---|---|---|---|---|---|---|---|---|
| Market | Domestic | Export | | Domestic | | Export | Domestic | | Export |
| % | 80% | 20% | | 94% | | 6% | 100% | | 0% |
| Condition | Fresh | Fresh | Frozen | Fresh | Frozen | Fresh | Fresh | Frozen | Fresh |
| % | 100% | 51% | 49% | n/a | n/a | 100% | n/a | n/a | - |
| Tonnes | 1,755 t | 447 t | | 109 t | | 6 t | 123 t | | - |

n/a – not available

# 23.4 Government revenue from fisheries

## Access fees for offshore fishing

No licences to fish have been issued to foreign vessels since early 2001 (Anon. 2022b) and consequently, no fees have been paid for fishery access by foreign vessels. There are no access fees for domestic vessels.

## Other government revenue from fisheries

In general, in New Caledonia the fisheries sector does not generate revenue for the government, but rather absorbs various types of government subsidies.

One popular subsidy is that for fuel for fishing vessels. Fabry and Laplante (2022) state that in 2020, 168 beneficiaries enjoyed a subsidy covering 556,999 litres of fuel at a cost of 33 million XPF. The Institut d'Émission d'Outre-mer (IEOM 2019) indicates that shrimp aquaculture received a total of 300 million XPF in subsidies from four government agencies.

# 23.5 Fisheries-related employment

New Caledonia's annual statistical summary for coastal professional fishers (Fabry and Laplante 2022) gives information on the numbers, types and location of fishers (Table 23-10). The document also indicates:

- 75% of the fishers on the table are men and 25% are women
- The median age is 52 years for both men and women

**Table 23-10:** Number and types of registered coastal professional fishers in 2020

| Province | Head fishers using boats | Head fishers fishing from shore | Deck crew | Total fishers |
|---|---|---|---|---|
| Southern Province | 130 | 0 | 75 | 205 |
| Northern Province | 246 | 45 | | 291 |
| Loyalty Islands | 47 | 0 | | 47 |
| **Total** | **423** | **45** | **75** | **543** |

Units = number of people

There is a scarcity of readily available information on the number of people participating in subsistence fisheries in New Caledonia. Virly (2000) gives the results of an older study of subsistence fishing. The survey involved administering a questionnaire to 1,000 people in the three provinces of New Caledonia. The results showed that half of the respondents fished one to three times per week. A report on the general state of fisheries in New Caledonia (Dupont 2022) indicates the percentage of households that fish in each area of New Caledonia, with the majority presumably involved in subsistence fishing: greater Noumea (17% of households involved in fishing), northwest (28%), northeast (27%), southeast rural (32%), southwest rural (26%) and Loyalty (27%).

In a publication of the Direction Des Affaires Maritimes (DAM 2019), the number of people employed on New Caledonia's offshore fleet is given (Table 23-11). The results of an earlier study on offshore employment (DAM 2014) shows that the number of people in offshore fishing companies that are employed ashore (vessel management, processing and fish wholesaling) is about equal to those employed on the vessels.

**Table 23-11:** Number of people employed on longline vessels

| Province | 2016 | 2017 | 2018 |
|---|---|---|---|
| Province des Îles Loyauté | 4 | 4 | 4 |
| Province Nord | 18 | 15 | 21 |
| Province Sud | 93 | 142 | 168 |
| Total New Caledonia | 111 | 157 | 189 |

For aquaculture employment, the website for Agence Rural (www.agence-rurale.nc) states that in New Caledonia shrimp farming there are 244 salaried workers in the ponds and farms and 306 salaried workers in the workshops. A study of shrimp farming in New Caledonia (IEOM 2019) indicates that this type of aquaculture provides 1% of all private sector jobs in the territory.

A study in 2013 stated that despite the relatively young population of New Caledonia, fishers are getting older, which could be an indication of the non-attractiveness of the sector. The average age of a fisher in the Province Nord was 53.5 years, and in the Province Sud it was 50 years (CNPMEM 2013).

## 23.6 Levels of fishery resource consumption

Some older reports on fish consumption in New Caledonia are:

- Dupont et al. (2004) indicate that in 2003, 4,632 t of fish and crustaceans, from both domestic fisheries and imports, were consumed by households in New Caledonia. The annual per capita consumption of fish and crustaceans was considered to be 21.6 kg.
- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in the Pacific Island region. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. For all of New Caledonia, the annual per capita fish consumption (whole weight equivalent) was 25.6 kg. For rural areas, the figure for per capita consumption of fish was 54.8 kg, and for urban areas, it was 10.7 kg.

A report on the general state of fisheries in New Caledonia (Dupont 2022) indicates the consumption of fish per week by households that are involved with fishing. In all of New Caledonia in 2017 there were 17,034 fishing households and 68,029 non-fishing households. The fishing household consumption of fish by area in 2017 was: greater Noumea (5.7 kg of fish per week per fishing household), northwest (8.7 kg), northeast (11.2 kg), southeast rural (12.5 kg), southwest rural (6.0 kg) and Loyalty (8.6 kg). The total for all fishing households in New Caledonia was 7.1 kg.

Relatively new sources of fishery products for domestic consumption have become available. Longlining started in Noumea in the early 1980s, and in 2021 the 18 licensed domestic longliners landed 2,626 t of tuna and other pelagic fish (Anon. 2022b). About 80% of the offshore catch in 2021 was for the domestic market. This equates to 6.7 kg of fish annually for each of the 273,674 residents of New Caledonia. Similarly, of the 1,460 t of shrimp produced in 2021, about half was consumed domestically. This equates to 2.7 kg of shrimp annually for each resident.

A report by the Coastal Fisheries Observatory (OPC 2022) cites a 2016 study that indicated that the people of New Caledonia consume 8,700 t of fish from the lagoon each year. This equates to 31.8 kg of lagoon fish annually for each of the 273,674 residents of New Caledonia.

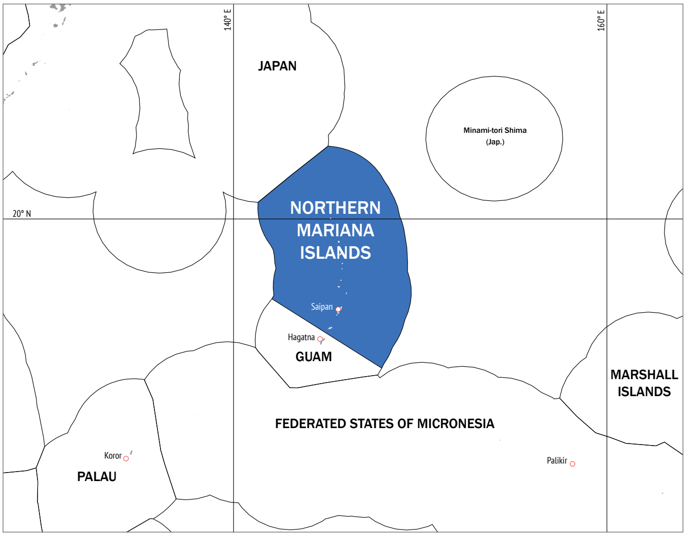
If this 31.8 kg is added to the per capita consumption of pelagic fish given above (6.7 kg) and the per capita consumption of shrimp (2.7 kg), the total is 41.2 kg per capita per year. It is interesting to note that this is 61% greater than the annual per capita consumption of fish in New Caledonia given above by Bell et al. (2009b).

## 23.7 Exchange rates

The average yearly exchange rates (XPF to the US dollar) used in this book are as follows:

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 89.88 | 86.01 | 98.13 | 108.81 | 114.17 | 99.42 | 104.39 | 106.78 | 98.00 | 105.37 | 120.27 |

# 24 Northern Mariana Islands




## 24.1 Volumes and values of fish harvests in the Northern Mariana Islands

### Coastal commercial catches in the Northern Mariana Islands

A recent report by the Western Pacific Regional Fishery Management Council (WPRFMC 2022b) describes the fisheries of the Commonwealth of the Northern Mariana Islands (CNMI) and their dynamics (Box 24-1).

**Box 24-1:** Fisheries in CNMI and recent changes

The CNMI has had numerous changes in its fisheries over the past twenty years. In the mid1990s, commercial fishing activities increased significantly. Commercial SCUBA fishing became a common method, not only to support local demand for reef fish, but to bolster exports to Guam as well. Large-scale commercial bottomfish fishing in the Northern Islands of the CNMI peaked starting in the mid-1990s through 2002, with landings being both sold locally and exported to Japan. Troll fishing continued to be dominant during this period. An exploratory, deepwater shrimp fishery also developed, but did not last due to internal company issues and gear losses. Around this time, a sea cucumber fishery also began on Rota before migrating to Saipan; ultimately, however, this fishery was found to be unstable and was subsequently halted. Several fishing companies entered the fisheries only to close down a few years later. The CNMI reached its highest population during the last two decades, most of whom have been migrant workers from Asia. The tourism industry has also been increasing, which contributes to high demand for fresh fish. Subsistence fishing within the nearshore waters of Saipan, Tinian, and Rota has also increased. In the 2000s, small-scale troll, bottom and reef fish fisheries persisted, with landings sold locally. Federal and state support was provided multiple times to further develop fisheries in the CNMI with intermittent success. An exploratory longline fishery was funded and operated in the CNMI in the mid-2000 for about two years, but eventually closed down due to low productivity of high-value, pelagic fish, among other issues within the business. A few larger (40-80') bottomfish fishing vessels were also operational during this period, with a majority of them fishing the northern islands and offshore banks. A few of these vessels were recipients of financial assistance to improve their fishing capacities. Fisheries in the CNMI have generally been relatively small and fluid, with 16-20' boats fishing within 20 miles from Saipan. Many of these small vessels conduct multiple fishing activities during a single trip. For example, a company that is supported mainly by troll fishing may also conduct bottomfish fishing and spearfishing to supplement their income. Fishing businesses tend to enter and exit the fishery when it is economically beneficial to do so, as they are highly sensitive to changes in the economy, development, population, and regulations. Subsistence fishing continues; however, fishing methods and target species have shifted in step with population demographics and fishery restrictions. Nearshore hook and line, cast net, and spear fishing are common activities, but fishing methods such as gill net, surround net, drag net, and SCUBA-spear have been restricted or outright banned in the CNMI since the early 2000s.

Source: WPRFMC (2022b)

There are a variety of programmes collecting information on the fisheries of CNMI. The Division of Fish and Wildlife (DFW) has two types of creel surveys: boat-based and shore-based. In addition, there is a commercial receipt book system for collecting data on commercial landings in which fish dealers fill out a form each time they purchase fish from fishers.

In CNMI (as in American Samoa and Guam), there is no shortage of fishery surveys and associated results – but trying to use that data to estimate total fishery production is not straightforward.

There have been two major attempts to estimate the production of coastal commercial fishing across the Pacific Island region that have included CNMI. These are:

- Dalzell et al. (1996) used information from a 1994 report of the Western Pacific Fisheries Information Network (WPacFIN) to estimate mean annual commercial fisheries production in CNMI of 141 tonnes (t), worth US$613,804.
- Gillett (2009a) used a 2008 WPacFIN report to estimates that the 2007 production from coastal commercial fishing in CNMI was 231 t, worth US$950,000 to fishers.

In addition to the above studies, there have been several other estimates of coastal fisheries production in CNMI, many of which have yielded very different results. At least some of the differences have arisen for the following reasons: (a) some deal with only reef fish, while others with both reef and pelagic fish; (b) some cover only Saipan, while others also include Rota and Tinian; (c) there are different ways of dividing the production between commercial and subsistence components; and (d) there are different ways of adjusting the survey results to produce total fisheries production.

To learn more about estimating the total coastal fisheries production of CNMI, discussions were held in November with DWF staff, independent fisheries specialists familiar with CNMI fisheries and Honolulu-based National Oceanic and Atmospheric Administration (NOAA) Fisheries staff. Several of those individuals indicated that the reports by WPRFMC and the information on the WPacFIN[1] data portal of NOAA Fisheries are probably the most accurate and helpful.

A recent and comprehensive report by WPRFMC (2022b) makes an estimate of the "total catch" from creel survey results (both boat-based and shore-based) as well as the commercial landings from the commercial receipt book system. The report states "the difference between the creel total and the commercial landings is assumed to be the non-commercial component." Upon closer

[1] Established in 1981, the Western Pacific Fisheries Information Network (WPacFIN) is a cooperative programme involving the WPacFIN Central office at the Pacific Islands Fisheries Science Center and participating fisheries agencies in American Samoa, the Commonwealth of the Northern Mariana Islands, Guam and Hawaii. WPacFIN helps its partner agencies consolidate, summarise, and provide access to the available fisheries data to meet the needs of fishery managers, scientists and fishermen.

reading of the document, the “total catch” is not the total catch of CNMI, but of specific fisheries (e.g. bottomfishing, spearfishing).

The WPacFIN data portal has a data query function from which it is possible to obtain “total fish catches by island area”. One of the options is “WPacFIN’s Best Estimated Total Commercial Landings” for CNMI. Using that information, it is possible to construct Table 24-1 below.

Table 24-1: “Best Estimated Total Commercial Landings” of CNMI from WPacFIN

| | Estimated commercial (pounds) | Estimated commercial value (US$) |
|---|---|---|
| 2016 | 296,584 | 759,343 |
| 2017 | 283,686 | 723,591 |
| 2018 | 271,290 | 698,973 |
| 2019 | 224,313 | 670,006 |
| 2020 | 214,702 | 582,939 |
| 2021 | 403,740 | 1,175,803 |

Source: Adapted from https://apps-pifsc.fisheries.noaa.gov/wpacfin/total-landings.php

There are some reservations about the information in the table. Both DFW staff and independent fisheries specialists have expressed concern that the shore-based creel survey underestimates the true amount of landings – especially for the important component of night spearfishing. However, many of the NOAA Fisheries staff interviewed in the present study expressed the opinion that “best estimated” catches have been expanded to account for underreporting, but there appears to be some uncertainty. The large increase in total commercial catch between 2020 and 2021 seems counterintuitive as several fisheries specialists in CNMI have expressed the view that during the Covid period, commercial fishing effort decreased.

Despite the above reservations, the present study will assume that “WPacFIN’s Best Estimated Total Commercial Landings” (i.e. Table 24-1 above) is a reasonably accurate assessment of total commercial fish landings in CNMI and will be used in this study.

Given that 2021 was atypical due to Covid, the impacts of Covid on fisheries landings in CNMI deserves some attention. A report by the U.S. National Marine Fisheries Service (NMFS 2021) on Pacific Island fisheries impacts from COVID-19 comments on the situation in CNMI (Box 24-2).

**Box 24-2:** The impacts of Covid on fisheries in CNMI

The Commonwealth of the Northern Mariana Islands has implemented strict protective measures to prevent the spread of the novel coronavirus, including social distancing and cancellation of public gatherings associated with a public emergency declaration coupled with a stay-at-home work-at-home order (March 17), and all inbound travelers, including returning residents, are required to undergo a 14-day quarantine (March 23). Tourism is by far the largest industry in the CNMI and COVID-19 impacts began in February, with 11 major hotels collectively reporting the lowest occupancy rates ever recorded at less than 20%, with hotels starting the planning stage of laying off employees, closing entire wings, closing restaurants, and suspending contracts for outsourced services. In response to this dramatic decline in tourists, the CNMI government implemented austerity measures to balance projected budget shortfalls, which among other measures include 16-hour cuts (64-hour bi-weekly work schedule) to government employees. The first two confirmed positive cases for COVID-19 in the CNMI occurred on March 29.

CNMI small boat fisheries are a mix of subsistence, cultural, recreational, and quasi-commercial fishers. Fish and fishing and integral parts of the culture and important component of the social fabric in the CNMI. In addition to social importance, most fishermen consider the fish they catch to be an important source of food for their families. Fishing is critically important in terms of building and maintaining social and community networks, perpetuating fishing traditions, and providing fish to local communities as a source of food security. In considering COVID-19 impacts to the CNMI fishing community, the Saipan Fishermen's Association cancelled their annual Mahimahi Fishing Derby scheduled for March 28. In response to the first two positive cases, one of which had travelled to Tinian, on March 30 the Tinian government implemented a "sunset-to-sunrise" curfew and closed the harbor to recreational and commercial fishing, limiting the opportunities for fishing to support the community in these trying times.

On a more practical level, staff of DFW (M. Tenorio, per. com. November 2022) provided perspectives on the fishery impacts of Covid in CNMI. These included:

- Reduced demand for fish from the large tourism industry.
- The formal fish markets closed, but roadside fish vendors continued with increased throughput.
- The ice making facilities were closed.
- Subsistence fishing effort, especially shore-based, increased to compensate for reduced ability to buy food.
- Commercial fishing effort decreased due to marketing difficulties.

In order to value the fish landings, information from NOAA Fisheries' Western Pacific Fisheries Information Network data portal is used. The estimated commercial value in "WPacFIN's Best Estimated Total Commercial Landings" (cited above) can be divided by the estimated catch to give a price per pound for the various year (Table 24-2).

**Table 24-2:** Fish prices in WPacFIN's "Best Estimated Total Commercial Landings"

| | Estimated commercial catch (pounds) | Estimated commercial value (US$) | Price to fishers (US$/pound) |
|---|---|---|---|
| 2016 | 296,584 | 759,343 | 2.56 |
| 2017 | 283,686 | 723,591 | 2.55 |
| 2018 | 271,290 | 698,973 | 2.58 |
| 2019 | 224,313 | 670,006 | 2.99 |
| 2020 | 214,702 | 582,939 | 2.72 |
| 2021 | 403,740 | 1,175,803 | 2.91 |

Source: Adapted from https://apps-pifsc.fisheries.noaa.gov/wpacfin/total-landings.php

In the Northern Mariana Islands Fishing Community Profile (Ayers 2018), there is a note about fish prices in CNMI:

> The average price per pound for CNMI fish (in nominal terms) has declined since 1990. While mean prices for CNMI fisheries remain flat (and decline after adjusting for inflation), fishers reported that fishing costs, particularly for bait, tackle, and fuel have significantly increased in recent years. According to the fishers interviewed, economic issues were said to have the largest negative impact to CNMI fishing communities.

Following from the information presented in this section, the coastal commercial fisheries production in CNMI in 2021 is estimated to be 403,740 pounds (183 t), worth US$1,175,803 to the fishers.

## Coastal subsistence catches

The historical attempts to estimate coastal subsistence production in CNMI have been:

- Zeller et al. (2007) used a statement in a 1947 report to estimate subsistence fish production in CNMI in 1950 of 456 t: The native population of Saipan is somewhat in excess of 4,600 persons, and since they traditionally consume nearly a pound of fish per day, there is a steady market for fishery products (Smith 1947).
- Dalzell et al. (1996) estimated a subsistence catch of 2,825 t (worth US$12.3 million) for the early 1990s. Subsequent discussions with a researcher of that study suggest that the estimate may have been

erroneously inflated by leakage of fish from the Zuanich tuna facility (P. Dalzell, per. com. December 2008).

- Other estimates of subsistence production have been derived through the percentage of the estimated total catch. For example, a CNMI Division of Fish and Wildlife study in the early 1990s (Graham 1994) assumed that subsistence catches were 1.7 times the volume of commercial reef fish landings.
- Hospital and Beavers (2014) was a survey of 112 boat-based fishermen on the islands of Saipan (80% of sample), Tinian (10%) and Rota (10%). They gave results on the disposal of the catch: approximately 28% of fish catch was reported to be consumed at home, 38% was given away to relatives, friends or crew, and approximately 29% of fish was sold in the past 12 months. The remaining catch was either released (2%) or exchanged for goods and services (3%). This diversity of catch disposition extends across all subgroups of the fishery including fishery highliners who, despite their avid market participation, still retain approximately 22% of the fish they catch for home consumption and participation in traditional fish-sharing networks and customary exchange.
- Cuetos-Bueno and Houk (2014) examined several historical estimates of CNMI's coastal subsistence production, which ranged from a maximum of 456 t per year in the 1950s to around 100 t per year in the early 2000s. They also re-assessed the Van Beukering et al. study (2006) and concluded subsistence reef fisheries production for CNMI of between 235 t and 470 t for the mid-2000s.
- Gillett (2016) indicated that subsistence fisheries production in CNMI in 2014 was likely to have been around 350 t, worth about US$1.4 million to fishers.

Several people interviewed in the present study offered the opinions that (a) the production from coastal subsistence fisheries has historically been about the same or slightly more than that from coastal commercial fisheries, and (b) during the Covid period, subsistence fishing effort, especially shore-based fishing, increased to compensate for reduced ability to buy food, and commercial fishing effort decreased due to marketing difficulties.

Following from the previous section on coastal commercial fishing in CNMI and taking into consideration the information in the above paragraph, the 2021 coastal subsistence catch is judged to be 450,000 pounds (204 t). Using the commercial prices in Table 24-2 in the section above (i.e. US$2.91/pound) and the farm gate method of valuing subsistence production, this was worth US$915,960 to the fishers.

## Locally based offshore catches

The last locally based offshore fishing operation in CNMI is described by Allen and Amesbury (2012) in Box 24-3.

**Box 24-3:** The rise and fall of locally based offshore fishing in CNMI

In 2008, a longline fishing company began operating out of Saipan. USA Islands Seafood Inc. (USAISI) was purchased by private investors in May 2008. The firm's mission was to produce, process and market quality fish and processed fish products at competitive prices in the local market and to establish itself as the leading seafood exporter in the region. The company aims to maintain an environmentally friendly and sustainable fishery to assist in protecting and preserving the fishery reserves of the CNMI. The USAISI fishing fleet in Saipan was made up of 4 vessels, the 70-ft F/V Jenny (which appeared in the movie The Perfect Storm), the 80-ft F/V Pacifica, the 85-ft F/V Miss Saipan, and the 100-ft F/V Lady Carolina. Its website lists 12 species of fish that they caught: 4 species of tuna (albacore, bigeye, yellowfin, and skipjack); 4 species of billfish (blue marlin, striped marlin, shortbill spearfish, and broadbill swordfish); and 4 other species (mahimahi, wahoo, opah, and monchong). According to one of the owners, Dave Lewis, they also caught and marketed about 10 sharks a month (threshers, makos, white tips, blue sharks, and even the shallower black tips). However, USAISI has shut down operations and does not fish anymore in the CNMI.

Source: Allen and Amesbury (2012)

In the period 2009–2022, there was no locally based offshore fishing in CNMI.

## Foreign-based offshore catches

There is no authorised foreign fishing in the CNMI zone.

## Freshwater catches

There are no freshwater fisheries in CNMI.

## Aquaculture harvests

The CNMI aquaculture Development Plan (NMC 2011) describes the aquaculture situation a decade ago (Box 24-4).

**Box 24-4:** Aquaculture in CNMI in 2011

While aquaculture in CNMI remains primarily based on tilapia and shrimp culture, the industry is growing and there is increasing recognition of the potential and need for aquaculture development in CNMI. Saipan AquaCulture — the largest commercial producer of shrimp — uses 32 concrete tanks with re-circulating systems. The company produces shrimp for local consumption and export to Guam. In 2009–2010, Saipan AquaCulture also began exporting SPF shrimp broodstock to Asia. Saipan AquaCulture has its own hatchery and is also becoming a provider of post-larval shrimp to two of CNMI's smaller shrimp producers, a factor that is likely to lead to a general expansion in the industry. The two other shrimp producers in CNMI are based on Rota and Saipan, and use small-scale re-circulating systems for production. Another small shrimp farm is under construction on Saipan. There are eight tilapia farmers in CNMI (five in Saipan, two in Rota and one in Tinian). Nearly all farmers use re-circulating production systems. Fry production is currently the responsibility of the Northern Marianas College, although one farmer has recently installed a small hatchery system for producing fry for sale. Three strains of tilapia are currently in production: the Chitralada variety from Thailand (Oreocrhomis niloticus), red Thai Variety (Red Hybrid), and Pearl White Variety. Production in 2009 was estimated at 10 mt with a value of USD 56,000. Fish are sold live or fresh, usually at a size of 200–250 g, for a price of USD 5–6 per kg.

Gillett (2016) reported on the aquaculture production in CNMI in 2014, as follows:

- The shrimp *Litopenaus vannamei* for Saipan and Guam markets: 2014 production was about 25 tons (i.e. short tons; 50,000 pounds)
- *Litopenaeus* broodstock for export: 2014 production was about 15,000 pieces
- Tilapia (both live and fresh) sold in stores, farmers' markets and direct to customers' doors: 2014 production was about 40,000 pounds

The Aquaculture Specialist of the Northern Marianas College stated that after a typhoon in 2015, the shrimp farms in CNMI were damaged and all production stopped. Now, the only aquaculture in CNMI is limited to tilapia. In 2021 about 5,000 pounds of tilapia were produced, with a farm gate price of about US$3 to $3.50 per pound (M. Ogo, per. com. November 2022). This equates to 2.27 t, with a farm gate value of $16,250.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values[2] of the fishery and aquaculture harvests in 2021 can be made (Table 24-3).

**Table 24-3:** Annual fisheries and aquaculture harvest in CNMI in 2021

| Harvest sector | Volume (t) | Value (US$) |
|---|---|---|
| Coastal commercial | 183 | 1,175,803 |
| Coastal subsistence | 204 | 915,960 |
| Offshore locally based | 0 | 0 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 0 | 0 |
| Aquaculture | 2.27 | 16,250 |
| **Total** | **389.27** | **2,108,013** |

[2] The values in the table are dockside/farm gate prices.

Figures 24-1 and 24-2 show the volumes and values of CNMI fisheries production in 2021.

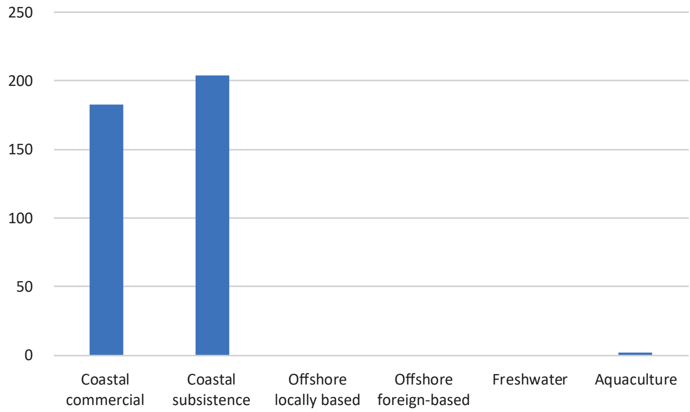



**Figure 24-1:** CNMI fisheries and aquaculture production in 2021 by volume (t)

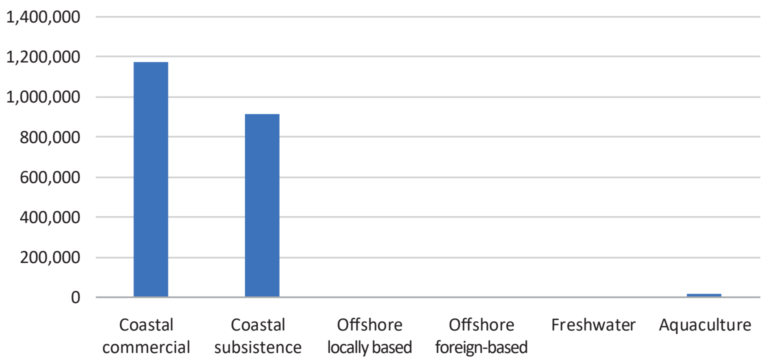



**Figure 24-2:** CNMI fisheries and aquaculture production in 2021 by value (US$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for CNMI from those studies are provided in Table 24-4.[3]

[3] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 24-4: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t and pcs, where indicated) | Nominal value (US$) |
|---|---|---|---|
| Coastal commercial | 1999 | n/a | n/a |
| | 2007 | 231 | 950,000 |
| | 2014 | 142 | 821,356 |
| | 2021 | 183 | 1,175,803 |
| Coastal subsistence | 1999 | n/a | n/a |
| | 2007 | 220 | 631,700 |
| | 2014 | 350 | 1,400,000 |
| | 2021 | 204 | 915,960 |
| Offshore locally based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Offshore foreign-based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 14 | 205,000 |
| | 2014 | 41 t and 15,000 pcs | 1,130,000 |
| | 2021 | 2.27 | 16,250 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies represents a real change in production in some cases, but this can also represent a change in the methodology used for measuring production (hopefully, an improvement) or the availability of new information. In the table above the production level for coastal subsistence fisheries drops significantly between the years 2014 and 2021. This is likely to be due to the use in 2021 of a new data source (i.e. "WPacFIN's Best Estimated Total Commercial Landings"), rather than a real change in the fisheries. In contrast, changes in production figures in the table for aquaculture likely reflect real changes in the amounts being harvested.

## 24.2 Contribution of fishing to GDP

### Current official contribution

The estimates of the GDP of CNMI are made by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce, under the Statistical Improvement Program funded by the Office of Insular Affairs of the U.S. Department of the Interior. The BEA also makes GDP estimates for American Samoa, Guam and the U.S. Virgin Islands (USVI).

The BEA has estimated that the current-dollar GDP of CNMI was US$1,182,000,000 in 2019, the latest date for which estimates are available (BEA 2021). The fishing contribution to GDP is not given in BEA documentation – and the staff of the Statistics Division of the American Samoa Department of Commerce are unaware of the amount of the fishing contribution.

### Method used to calculate the official fishing contribution to GDP

BEA (2021) states that estimates of current-dollar GDP for CNMI, American Samoa, Guam and the USVI are made using the expenditures approach, i.e. as the sum of goods and services sold to final users. It is calculated by summing personal consumption expenditures, private fixed investment, change in private inventories, net exports of goods and services, and government consumption expenditures and gross investment. No information is available on how BEA treats the fishing sector.

Officials of the Central Statistic Divisions in CNMI's Department of Commerce are not certain that the BEA GDP estimate for CNMI considers the fishing sector (J. Andrew, per. com. November 2022).

### Estimate of fishing contribution to GDP

Table 24-5 (below) represents one option for estimating fishing contribution to the GDP of CNMI. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 24.1 above (summarised in Table 24-3) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

Table 24-5: Fishing contribution to CNMI GDP in 2021

| Harvest sector | Gross value of production (US$, from Table 24-3) | VAR | Value added (US$) |
|---|---|---|---|
| Coastal commercial | 1,175,803 | 0.60 | 705,482 |
| Coastal subsistence | 915,960 | 0.80 | 732,768 |
| Offshore locally based | 0 | 0 | 0 |
| Freshwater | 0 | 0 | 0 |
| Aquaculture | 16,250 | 0.50 | 8,125 |
| **Total** | **2,108,013** | --- | **1,446,375** |

The contribution of fishing to CNMI's GDP in 2021, estimated in the above table (US$1,446,375), represents about 0.12% of the US$1,182,000,000 GDP estimate for CNMI for 2019.

## 24.3 Exports of fishery production

Gillett (2016) indicated that fishery exports of CNMI in 2014 were limited to shrimp and shrimp broodstock, worth US$712,500. After a typhoon in 2015, the shrimp farms in CNMI were damaged, and all production stopped.

For the purposes of the present study, it is assumed that CNMI exported no fishery products in 2021.

## 24.4 Government revenue from fisheries

### Access fees for offshore fishing

There is currently no authorised foreign fishing in the CNMI zone, and no access fees are received from foreign vessels. U.S. vessels are considered to be domestic vessels. There are no access fees for domestic vessels.

### Other government revenue from fisheries

According to financial information provided in DFW's 2019 Citizen Centric Report (DFW 2020), the Division receives no money from fisheries licenses or fisheries-related fines.

## 24.5 Fisheries-related employment

There are several older studies that contain information on aspects of fisheries employment:

- Rhodes et al. (2011) state that in Saipan, several professional, locally owned fishing operations supply markets in Saipan. These operations each consist mainly of three to four full-time, low-paid, non-resident workers, with catch-based incentives as part of their salary. More than 50 professional fishers are estimated to work for formal businesses, while the number of independent and semi-subsistence fishers is unknown.
- Van Beukering et al. (2006) state that fishing is an important cultural activity on Saipan, even if it is for pleasure, rather than for catching fish to eat or sell. Twenty percent of all people interviewed in that study were active fishers, and they fish once every week or two weeks. For some, giving fish to family and friends is a traditional practice or is otherwise a way of demonstrating care.
- Hospital and Beavers (2014) provide the results of interviews with 112 CNMI fishers. Fishers were asked about compensation arrangements for their time and assistance, which elicited a diversity of responses across the fleet. About 45% of crew fishers reported that they receive no compensation for their time as crew members, many of whom indicated that they were family or friends who simply enjoyed fishing. Additionally, 15% reported that they contribute a portion of trip costs in exchange for the fishing opportunity. Of the crew survey respondents who receive compensation, approximately 40% reported that they keep a percentage of total fish caught on a trip, with the mean percentage being 39%. No crew fishers reported that they keep all of the fish they catch on a trip. For crew members involved in trips where fish are sold, 71% reported that they receive a share of trip revenues (an average of 33% of trip revenues).

Most of the recent general surveys in CNMI have little useful information about fisheries-related employment:

- The Labor Force Survey of 2017 (CSD 2018a) does not mention "fish" or "fisher" in the text of the survey report.
- In the 2017 CNMI Population Characteristics Report (CSD 2018b), all data related to fishing are aggregated with fishing and forestry to form the category "Farming, Fishing, and Forestry".
- The 2020 CNMI Census output reports aggregated fisheries results to form the category "Agriculture, forestry, fishing and hunting, and mining" (CSD 2021a).
- The employment information in the 2016 household income and expenditure survey is aggregated with other sectors to form the category "agriculture fishing quarrying utilities" (CSD 2017).

A recent report by the WPRFMC (2022b) has information on fisheries-related employment:

- The most recent records obtained from the CNMI Department of Public Safety (DPS) are from 2018: 138 vessels were scheduled to be renewed by December 31, 2019; 10 vessels were registered as commercial fishing vessels; and 91 were registered for personal use, although an unknown amount was and continue to be used for commercial fishing regardless of their intended use specified on the registration.
- A household survey conducted in 2012 found that 37% of households had at least one individual that self-identified as a fisherman. Respondents from fishing households tended to be younger, possess lower education levels and have a higher rate of unemployment than respondents from non-fishing households.
- Fishing in CNMI is a social activity; only 3% of fishermen reported fishing alone, but 70% reported that their boat is used without them on occasion. In addition, the majority of fishermen (57%) agreed that as a fisherman, they are respected by the greater community. Nearly a third of respondents were neutral (27%) regarding this sentiment, while some were hesitant to express an opinion or simply did not know (13%). The study found that very few fishers (3%) felt that they were not respected by the community.

Northern Mariana Islands Fishing Community Profile (Ayers 2018) states that fish and fishing are an important part of culture and a reliable source of local food for CNMI fishing communities. However, interview data indicate that opportunities to make a living from fishing remain elusive.

## 24.6 Levels of fishery resource consumption

Historical studies that provide information on CNMI fish consumption are (in chronological order):

- Gillett and Preston (1997) estimated that production from coastal fisheries (commercial and subsistence) in CNMI in the early 1990s equated to an annual per capita fish supply of 66.5 kg. This figure was partially based on the Dalzell et al. (1996) production estimate of 2,825 t annually from CNMI's subsistence fisheries – this amount appears unreasonably large.
- Zeller et al. (2005) state: "the per capita catch rate may have declined from a high of potentially 72.6 kg per person per year in 1950 to 2.9 kg per person per year by 2002."
- Van Beukering et al. (2006) state that nearly half of the respondents in their survey reported eating "somewhat less fish" than they did 10 years ago. The majority said they ate fish between one and three times per

week (28% said every two days, 27% said twice a week and 23% said once a week). Of the remainder, 4% said they eat fish every day, and 18% ate fish either once or twice a month.

- Zeller et al. (2007), citing Smith (1947), suggest annual per capita consumption during the late 1940s of approximately 166 kg per year.
- Gillett (2009a) states that unpublished data from the 2005 household income and expenditure survey (HIES) indicate that the amount of fish from domestic commercial fishing and canned imports equates to 4.7 kg per capita per year. This amount does not include the production from domestic subsistence fisheries, nor from non-canned imported fish. The study adds: "It can be stated that estimating the per capita fishery product consumption for CNMI residents is complicated by large amount of canned and non-canned seafood imports, the presence of a large tourist population, and a subsistence fishery that was not covered by the 2005 HIES nor explicitly by current fishery monitoring programmes."
- Bell et al. (2009b) cover per capita fish consumption across the Pacific Island region but indicate that: "Guam, Marshall Islands, Northern Mariana Islands and American Samoa were not included in the analyses because HIES from these Pacific Island countries and territories make no distinction between cash transactions and subsistence."
- Rhodes et al. (2011) estimate "total fish consumption" in CNMI to be 23 kg per person per year and "reef fish consumption" to be 7 kg per person per year. The source of that information is not indicated. The report also states: "Since 1962 nutritional programs have provided food subsidies to families in need. These programs, together with the market economy, have reduced the overall dependence upon local seafood for subsistence, while increasing the purchasing power of individuals. Access to food coupons resulted in a general decrease in local food production."
- Cuetos-Bueno and Houk (2014) state that 17% of households in Saipan actively participated in non-commercial reef fishing, with a mean monthly non-commercial catch of 16 kg per household per week.

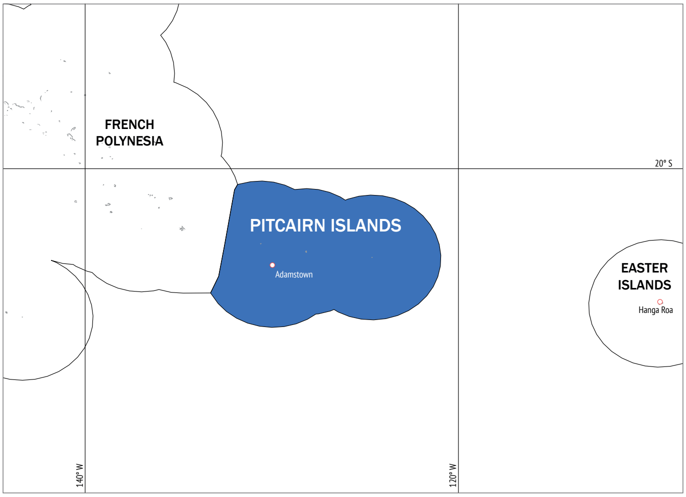
WPRFMC (2022b) states that while fish remain an important part of the local diet and an integral part of the people's history and culture, adaptation to and integration with a more westernised lifestyle appears to have changed people's dietary preferences on Saipan. Nearly half (45%) of the survey respondents reported eating "somewhat less fish" than they did a decade ago, although the majority still ate fish between one and three times a week. The majority also purchased their fish from a store or restaurant (40%), while 31% purchased fish from roadside vendors. Less common was acquiring fish from an extended relative/friend (13%) or their own catch (11%). Most of the fish consumed came from the U.S. mainland (41%), with other important sources coming from Saipan's coral reefs (31%), deepwater or pelagic fish caught off Saipan (23%), or fish imported from other Pacific Islands (e.g. Chuuk, 10%).

The Northern Mariana Islands Fishing Community Profile (Ayers 2018) discusses the Nutrition Assistance Program, which is sometimes referred to as the Food Stamp programme for CNMI. This programme supports CNMI residents who are U.S. citizens, U.S. Nationals or U.S. permanent residents living in households where a sum of total available household resources or assets are less than $2,000 and are also subject to monthly gross income limits. The Nutrition Assistance Program sets aside 30% of local coupons for food and products grown, caught or produced in CNMI. Local fish and fish products may be purchased with local coupons.

## 24.7 Exchange rates

CNMI uses the US dollar (US$).

# 25 Pitcairn




## 25.1 Volumes and values of fish harvests in Pitcairn

### Coastal commercial catches in Pitcairn

The Pitcairn Islands group is a British Overseas Territory. It comprises the islands of Pitcairn, Henderson, Ducie and Oeno. Pitcairn, the only inhabited island, is a small volcanic outcrop situated in the South Pacific at latitude 25.04 south and longitude 130.06 west. It is roughly 2170 km (1350 miles) east south-east of Tahiti and just over 6600 km (4100 miles) from Panama. The Islands' administrative headquarters are situated in Auckland, New Zealand, 5310 km (3300 miles) away (https://www.government.pn).

The following summarise the attempts to estimate coastal fish catches in Pitcairn in recent years:

- Dalzell et al. (1996) indicated that Pitcairn's annual commercial fisheries production was zero in the early 1990s.
- Gillett (2009a) considered fish sales by Pitcairn residents to cruise ships, the bartering of fish for goods from merchant ships, yachts and fishing vessels, and the per capita consumption of fish on the island. The study concluded that there was an annual coastal commercial catch on Pitcairn in the mid-2000s of 5 tonnes (t), worth NZ$51,000, and a coastal subsistence catch of 7 t, worth NZ$50,000.

- Gillett (2016) considered the findings of a trip to Pitcairn by a Pacific Community (SPC) officer, the population of Pitcairn, the number of part-time commercial fishers and non-commercial fishers, a study of social welfare on Pitcairn, and an economic analysis of the proposed Pitcairn marine reserve. He estimated that the 2014 coastal catch was 9 t, comprising 3 t of coastal commercial (worth NZ$18,000 to fishers) and 6 t of coastal subsistence (worth NZ$12,000 to fishers).

As background information, Box 25-1 describes coastal fishing and the sale/bartering of fish in Pitcairn.

**Box 25-1:** Coastal fishing in Pitcairn

The Pitcairn community fishes regularly for subsistence as well as for sale to passing cruise vessels and to the island's restaurant, which tends to be open just once a week when tourists are on the island. The cruise ships, visiting yachts and the few tourists who come to the island, provide the only opportunity currently for the Pitcairners to sell or trade their marine resources, mainly in the form of fresh fish (caught in the immediately preceding days and refrigerated) or live lobsters. Most of the island households eat fish, with several families having two to three fish meals a week.

Although a lot of fishing is undertaken from the rocky shores, many households own small wooden boats or skiffs fitted with an outboard motor to enable access to nearshore rocky and coral reefs to catch their favoured species, or for trolling for pelagic species. Most of the reef and shore fishing is conducted using handlines although some fishers use rod and line. A small number of islanders are scuba divers and catch fish through spear fishing or collect spiny lobsters by hand. On fine days, when the sea is calm and public duties have been completed, one of the longboats may be launched and a party of islanders will go fishing for an afternoon. On these occasions, all the fish caught by the party are divided up equally by household and shared out irrespective of individual catch size.

Fishing activities are significantly increased prior to the arrival of a visiting cruise ship, where there is a possibility of a commercial sale of fish and lobster. The Island's Provisions Officer (currently Steve Christian) coordinates orders, sales and share of returns among local fishers and maintains the records. The Pitcairn community is generally aware of the estimated time of arrival of most of the scheduled tourist vessels through a cruise ship calendar published online by the Pitcairn Islands Study Center. Up to 12 cruise ships visit Pitcairn each year during the cruising season (approximately December to April), although not all of these will purchase seafood due to their requirement for food safety certification. On average about 50 kg of tuna, 50 kg of wahoo and 50 kg of reef fish (mainly coral trout, grouper and parrotfish) are requested by each of four cruise ships (although these orders are not always fully met, being dependent upon weather conditions) and about 400 kg of lobsters in total are sold each year. Lobsters are rarely targeted for personal consumption, but in the weeks leading up to a cruise ship visit an intensive lobster fishing effort is undertaken.

Source: Irving and Dawson (2012)

In September 2011 an SPC fisheries officer visited Pitcairn (M. Blanc, per. com. August 2015) and collected a range of fisheries information. After the visit, SPC carried out an economic analysis of fisheries development options. The report of the analysis (Sharp 2011) contains information on the sale of fish:

> In terms of trade, Pitcairn Islanders make cash sales of tuna, wahoo, grouper and lobster to approximately 4 (of the 8) cruise ships that visit the Pitcairn Islands annually. This trade amounts to approximately 150 kg of fish and 100 kg of lobster per ship, at a price of US$8–10/kg and US$20/kg respectively (i.e. total revenue of approximately US$3,200 per ship or US$12,800 per annum). The only other form of export involves barter trade with passing transport vessels, which occurs 3 to 4 times annually. On average, 60 kg of mixed species are traded for various goods, including meat... By combining what is consumed domestically and what is traded on an annual basis, we gain an estimate of the total production of the fishery. Based on a domestic consumption of 7.84 mt per annum and annual cruise ship sales of 1 mt and transport vessel trade of 0.24 mt, we estimate an annual production of 9.08 mt per annum.

Additional information that may be useful for estimating Pitcairn's annual coastal fisheries production is:

- In 2021 the resident population of Pitcairn consisted of a population of fifty (www.government.pn).
- The local fishery is currently very small-scale, with just 12 regular fishers (Government of Pitcairn Islands 2021).
- The government of Pitcairn has established a large marine protected area (Box 25-2).

**Box 25-2:** The Pitcairn Islands Marine Protected Area

The Pitcairn Islands Marine Protected Area (MPA) encompasses the entire Exclusive Economic Zone and the territorial seas of Pitcairn, Henderson, Ducie and Oeno Islands (841,910 square kilometres).

The Pitcairn Islands Marine Protected Area Ordinance 2016 officially established the MPA in September 2016. It defines the boundary of the MPA, establishes the Coastal Conservation Areas, sets out the prohibited and regulated activities within the MPA, the relevant offences and penalties and enforcement.

The Marine Conservation Regulations allow:

- Residents of Pitcairn to fish in the territorial seas around Pitcairn Island if they hold a fishing permit.
- Residents of Pitcairn to fish in the territorial seas around Henderson, Oeno and Ducie Islands without a permit, provided that fishing is for consumption during the period of stay on the relevant island, is by a tended line and is conducted in accordance with the Fisheries Management Plan.
- Non-residents of Pitcairn to fish if they hold a fishing permit, provided that the fishing is for consumption by the person while on Pitcairn Island and they are accompanied by a lawful Pitcairn resident.

The Marine Conservation Regulations prohibit:

- Anchoring within the MPA unless directed otherwise
- Commercial diving within the MPA without a permit
- Discharge of a polluting substance from a vessel in any Coastal Conservation Area
- Killing, taking, hunting capturing or harassing any protected migratory species listed in Annex I and II of the Convention on Conservation of Migratory Species or any other wild seabird, including its eggs, without written authority of the Marine Environment Committee

Source: The Pitcairn Islands Marine Protected Area Management Plan (Government of Pitcairn Islands 2021)

As reported in the Pitcairn Islands Marine Protected Area Management Plan, Coghlan et al. (2017) indicate:

> Subsistence catches fell throughout the 1950 to 2014 period due to the declining population, with average catch declining from 12 to approximately 4 tonnes per year by 2014. Artisanal catches increased from an estimated catch of 0.6 tonnes per year in 2000 to 2003 to 1 tonne per year between 2004 and 2014.

There is no recent information on Pitcairn fish prices. Sharp (2011) reports that fish are sold on Pitcairn for NZ$2 per kg and US$8 to $10 to cruise ships, with lobster selling for US$20 per kg. For the present study, a semi-arbitrary NZ$3.50 will be used for local sales and NZ$20 for all sales to cruise ships.

In the absence of more complete information, for the purposes of the present study the volume of coastal catches given in Gillett (2016) will be used for the 2021 coastal catches: a 2021 coastal catch of 9 t, comprising 3 t of coastal commercial (worth NZ$27,000 to fishers) and 6 t of coastal subsistence (worth NZ$21,000 to fishers).

### Coastal subsistence catches

Following the logic in the above section on coastal commercial fisheries, the 2021 Pitcairn Island coastal subsistence catch is taken to be 6 t, worth NZ$21,000 to fishers.

### Locally based offshore catches

There is no locally based offshore fishing in Pitcairn.

### Foreign-based offshore catches

Due to the establishment of the Pitcairn Islands Marine Protected Area, there is currently no authorised foreign-based offshore fishing in the Pitcairn zone.

Two reports give some background of past offshore fishing in the Pitcairn zone:

- In a report by SPC's Ocean Fisheries Programme (Langley and Adams 2005), it was stated that since 1990 longline fishing activity in the vicinity of the Pitcairn Islands zone has been dominated by the Taiwanese distant-water fleet. There was also limited fishing activity by Japan, Korea, French Polynesia and China in the late 1990s. In subsequent years, the fishery has been dominated by the Taiwanese longline fleet.
- A report on the Marine Environment of Pitcairn Islands (Irving and Dawson 2012) states that in December 2006 a single, one-off licensing agreement was made to a Spanish-registered longliner by the Commissioner for the Pitcairn Islands for a flat fee of US$1,000, although only a few days of fishing took place due to a poor harvest. Sporadic illegal fishing within Pitcairn waters is suspected by Pitcairn Islanders, who have sighted foreign vessels in the vicinity of the islands that do not respond to any radio contact.

### Freshwater catches

There are no freshwater fisheries in Pitcairn.

## Aquaculture harvests

There are no aquaculture activities in Pitcairn.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values of the fishery harvests in 2021 can be made (Table 25-1).

**Table 25-1:** Annual fisheries and aquaculture harvest in Pitcairn in 2021

| Harvest sector | Volume (t) | Value (NZ$) |
|---|---|---|
| Coastal commercial | 3 | 27,000 |
| Coastal subsistence | 6 | 21,000 |
| Offshore locally based | 0 | 0 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 0 | 0 |
| Aquaculture | 0 | 0 |
| **Total** | **9** | **48,000** |

Figures 25-1 and 25-2 show the volumes and values of Pitcairn fisheries production in 2021.

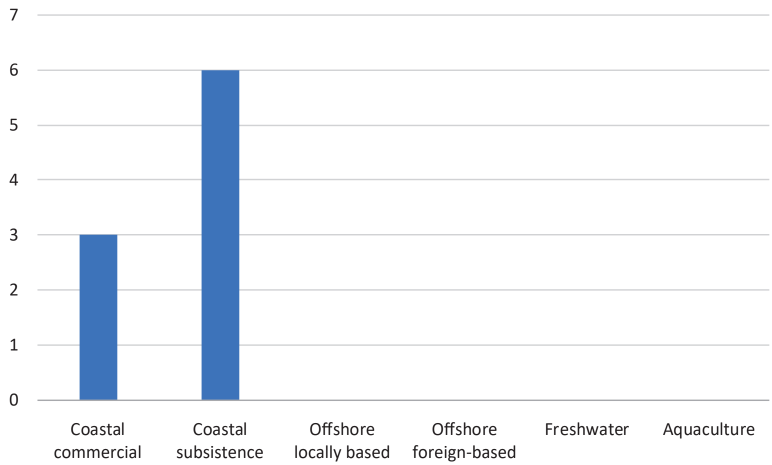



**Figure 25-1:** Pitcairn fisheries production in 2021 by volume (t)

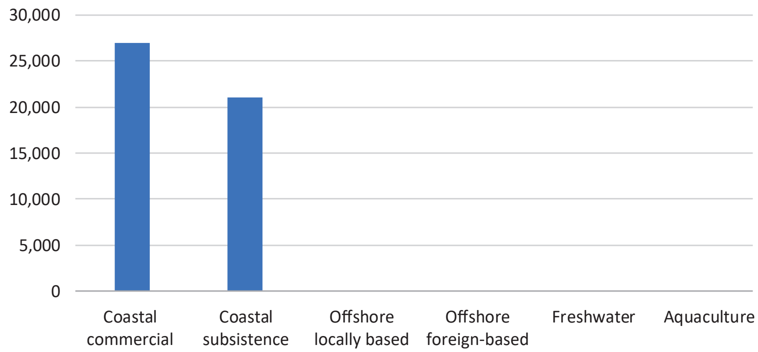



**Figure 25-2:** Pitcairn fisheries production in 2021 by value (NZ$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The earliest Benefish study (Gillett and Lightfoot 2001) did not include the non-independent territories; hence Pitcairn was not included. Table 25-2 compares the results of the three studies that included Pitcairn.

Table 25-2: Results of the Benefish studies for Pitcairn

| Harvest sector | Volume (t) | Value (NZ$) |
|---|---|---|
| Coastal commercial 2007 | 5 | 51,000 |
| Coastal commercial 2014 | 3 | 18,000 |
| Coastal commercial 2021 | 3 | 27,000 |
| Coastal subsistence 2007 | 7 | 50,000 |
| Coastal subsistence 2014 | 6 | 12,000 |
| Coastal subsistence 2021 | 6 | 21,000 |

From the above table, it is evident that volumes of production are fairly similar between the years, with the 2014 amount probably being more accurate due to information from a dedicated trip to Pitcairn for an SPC study (Blanc 2011), from which the 2014 estimates were made. The values are lower for 2014 because the unit price of fish for 2014 was based on information in the SPC study, which showed a fairly low fish price when domestic sales occur on the island. The 2007 values were based on the misconception that the only commercial fish transactions were sales to visiting vessels, for which the fish prices are relatively high.

## 25.2 Contribution of fishing to GDP

### Current official contribution

Official macroeconomic indicators, such as GDP or GNI, are not produced for Pitcairn.

### Method used to calculate the official fishing contribution to GDP

As there is no GDP estimate, there is no method for calculating the fishing contribution.

### Estimate of fishing contribution to GDP

Table 25-3 (below) represents one option for estimating fishing contribution to GDP in Pitcairn. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in Section 25.1 above (summarised in Table 25-1) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

Table 25-3: Fishing contribution to Pitcairn GDP in 2021

| Harvest sector | Gross value of production (NZ$, from Table 25-1) | VAR | Value added (NZ$) |
|---|---|---|---|
| Coastal commercial | 27,000 | 0.65 | 17,550 |
| Coastal subsistence | 21,000 | 0.95 | 19,950 |
| Offshore locally based | 0 | 0 | 0 |
| Freshwater | 0 | 0 | 0 |
| Aquaculture | 0 | 0 | 0 |
| **Total** | | | **37,500** |

The fishing contribution to the Pitcairn GDP in 2021 is NZ$37,500.

## 25.3 Exports of fishery production

The only exports of fishery products from Pitcairn are the catch that is sold to visiting vessels (cruise ships, merchant ship, yachts and fishing vessels).

An SPC study (Sharp 2011) estimated that this trade was approximately 1 t per year. Using the prices given above, this results in an annual value of about US$20,000 (NZ$28,500).

## 25.4 Government revenue from fisheries

### Access fees for offshore fishing

There is no authorised foreign fishing in the Pitcairn zone and no domestic vessels offshore.

### Other government revenue from fisheries

No information is available on other forms of government revenue from the fisheries sector.

## 25.5 Fisheries-related employment

The only readily available recent information on fisheries-related employment on Pitcairn is from the Pitcairn Islands Marine Protected Area Management Plan (Government of Pitcairn Islands 2021) which states: “The local fishery is currently very small-scale with just 12 regular fishers”.

## 25.6 Levels of fishery resource consumption

The major historical attempts to estimate per capita fish consumption are:

- Gillett and Preston (1997) estimates that the production from coastal fisheries in Pitcairn in the early 1990s equated to an annual per capita fish supply of 80 kg. However, that estimate was erroneously based on a population size of 100 people. The 1992 population of Pitcairn was 54 (Pitcairn Islands Study Center 2008). Using the revised population, the annual per capita fish supply would have been 148 kg.
- Gillett (2016) estimates a 2014 coastal commercial fisheries production of 3 t and coastal subsistence production of 6 t. If it is assumed that all of the subsistence production and 1.5 t of the coastal commercial production is eaten by the humans of Pitcairn (i.e. not used as cat food or sold to visiting vessels), then average annual per capita consumption is about 153 kg for the 49 residents.

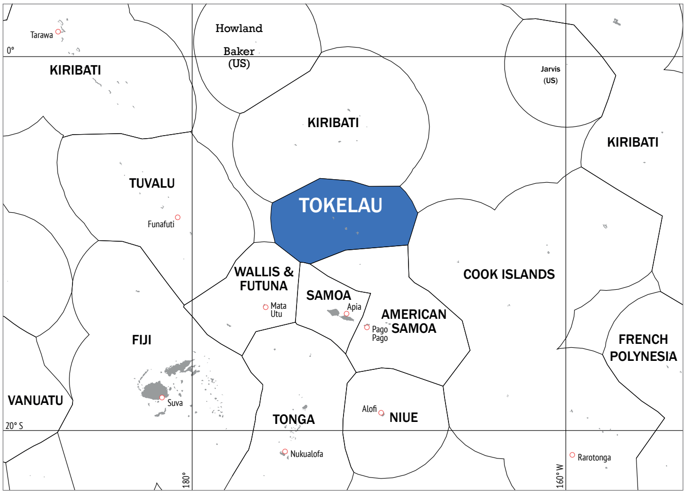
There have been no recent studies of per capita fish consumption on Pitcairn.

## 25.7 Exchange rates

Pitcairn uses the New Zealand dollar (NZ$). The average yearly exchange rates (NZ$ to the US dollar) used in this book are as follows:

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.21 | 1.22 | 1.28 | 1.47 | 1.44 | 1.42 | 1.48 | 1.50 | 1.40 | 1.47 | 1.74 |

# 26 Tokelau




## 26.1 Volumes and values of fish harvests in Tokelau

### Coastal commercial catches in Tokelau

Historical attempts to estimate the production from Tokelau's coastal fishing include:

- Gulbrandsen (1977) estimates that an annual total of 28 tonnes (t) of fish was required to satisfy the nutritional requirements of the 665 residents of Fakaofo (84 t for all of Tokelau).
- Hooper (1984) monitored all fish catches on Fakaofo for a five-week period in 1981 and reported a weekly catch of about 1.5 t (234 t annually for all of Tokelau).
- Gillett and Toloa (1987) monitored all fishery catches on Fakaofo for a 12-week period from June to September 1986 and estimated that 23 t of fish was landed (299 t annually for all of Tokelau).
- Passfield (1998) indicates there was no commercial fishing in Tokelau, with the possible exception of that for giant clams: "Although clams are not actually harvested for sale as such, some people, particularly public servants with disposable income, pay unemployed men to harvest clams on their behalf."
- Dalzell et al. (1996) indicate that Tokelau's annual commercial fisheries production was zero in the early 1990s.

- The 2001 census (Anon. 2003) contains information on household income sources. It indicates that no households receive income from the sale of fish "every month or more".
- Gillett (2009a) examined the above and other studies and concluded that all coastal fishing in Tokelau is considered to be subsistence fishing, and that the commercial production is zero. He estimated that the 2007 coastal subsistence fishery production in Tokelau was 375 t, worth NZ$967,500.
- Gillett (2016) studied the 2011 Tokelau census report (Statistics New Zealand 2012), which shows there is at least some coastal commercial fishing in Tokelau: income is received from the sale of fish by 1% of the households on Atafu, 3% of those on Nukunonu and 6% of those on Fakaofo. That study also considered events in recent years that may have affected the production of coastal fisheries, such as exports, visitors to Tokelau, the start of the sea cucumber fishery, changes in the population of Tokelau and other factors. The report of the study concluded: "There is inadequate information for partitioning that catch into commercial and subsistence components, but for the purpose of the present study it will be assumed that 10% of the catch is commercial (i.e. 40 t). At a semi-arbitrary price to fishers of NZ$3.50 per kg (based on general market knowledge), the annual value of the coastal commercial catch equates to NZ$140,000".

There is a substantial amount of recent information on Tokelau's aluminium boat fleet. Although most of the catches by these vessels are made outside the reef, in the present study, they are considered part of the coastal fisheries. The Tokelau report to the Scientific Committee of the Western and Central Fisheries Commission (TFMA 2022) states:

> Tokelau's artisanal fleet consists of around 190, small 10' – 16' outboard motorised aluminium boats operating out of the three atolls. These vessels fish primarily for local consumption and use surface trolling and vertical handline methods that mainly target skipjack and yellowfin tuna. Most artisanal fishing activities in Tokelau's waters occur within 5 nautical miles from shore. Inshore fisheries are conserved and managed to meet the food security and cultural needs of each atoll. Domestic fisheries development in Tokelau is severely constrained by market access and lack of infrastructure. Any commercial inshore fisheries developments need to be authorised by the Taupulega (Village Council) of each respective atoll and is subject to a cost-benefit and market analysis, and an environmental impact assessment to demonstrate it will not jeopardise her food security and will result in creating net economic gains.

The report by Tokelau Fisheries Management Agency (TFMA 2022) also has information on the recent catches of the aluminium boat fleet (Table 26-1). The report states that the coverage of Tokelau coastal fishery continues to improve since the introduction of the Pacific Community (SPC) TAILS software in 2016.

**Table 26-1**: Estimated coastal tuna catches in Tokelau waters, 2018–2021

| | Raised estimates (t) | | | |
|---|---|---|---|---|
| | Skipjack | Yellowfin | Bigeye | **Total** |
| 2018 | 27.8 | 27.0 | 0.0 | **54.8** |
| 2019 | 39.6 | 21.1 | 0.0 | **60.6** |
| 2020 | 27.5 | 22.6 | 0.0 | **50.1** |
| 2021 | 18.3 | 30.6 | 1.7 | **50.6** |

Much of the above information in this section is about coastal fisheries in general and not specifically about coastal commercial fisheries – so this component deserves some attention. The 2015/16 household income and expenditure survey (HIES) (NSO 2016) indicates that 98.8% of the fish consumed and 100% of shellfish items are home-produced, suggesting that very little coastal commercial fishing is occurring.

The Tokelau Fisheries Policy[1] (Anon. 2011) states:

> Commercial fishing of inshore fisheries may be authorised by Taupulega[2] subject to a cost-benefit and market analysis and environmental impact assessment at an appropriate scale that shows the development is environmentally sustainable, will not jeopardise food security, and will create a net economic gain. Commercial fishing means any fishing activity where the fish is taken for the purpose of sale for money – this does not include traditional barter.

According to the Tokelau Fisheries Advisor, rather than considering that commercial coastal fishing has been banned, a more accurate description is that no commercial fishing has been authorised (L. Gould, per. com. November 2022).

For the purposes of the present study, the production of coastal commercial fisheries of Tokelau was zero in 2021.

[1] The policy was approved by the General Fono after also gaining approval from each of the three Taupulenga. There were extensive consultations throughout Tokelau on the development of the policy. The Tokelau Administrator has also endorsed the policy (L. Gould, per com. February 2023).

[2] The Council of Elders on each atoll.

## Coastal subsistence catches

In the previous Benefish report (Gillett 2016) the coastal fisheries production was estimated to be 400 t (40 commercial and 360 subsistence). Since that period some of the changes or concepts that may influence the estimation of coastal fisheries production are:

- According to SPC Statistics for Development Division (SDD) data, the population increased from 1,384 people in 2014 to 1,501 in 2021, an 8% expansion.
- In other Pacific Island countries, Covid affected coastal fisheries production. According to the Tokelau Fisheries Advisor, Covid had little, if any, effect on coastal fisheries in Tokelau.
- In 2014 there was an estimated 62 t of "frozen seafood" exported to Samoa, but there was little, if any, fishery exports in 2021 (see export section below).
- The coastal fisheries production of 400 t in 2014, minus the exports, equates to 338 t of fishery products for domestic consumption. That is equivalent to an annual per capita consumption of 244 kg (whole weight equivalent). While it is recognised that Tokelauans eat relatively large quantities of fish, 244 kg is significantly higher than the highest estimates made for places like Kiribati and Tuvalu where consumption of chicken and other meats are likely to be a fraction of that for Tokelau (see section below on levels of fishery resource consumption), as shown by the latest HIES for Tokelau (NSO 2016).
- The implication of the above point is that the Gillett estimate (2016) of 400 t of coastal subsistence fisheries production in 2014 may have been too high.

The above points are insufficient for extrapolating the 2014 coastal catches to 2021, but for the purposes of this study, it will be assumed that the coastal subsistence fisheries production of Tokelau in 2021 was 300 t.[3] The farm gate method of valuing subsistence production (i.e. using the market price of the product less the cost of getting that product to market) is not applicable for Tokelau where there is no market price for fish – but a semi-arbitrary value of NZ$3.50 per kg will be used. Accordingly, the value of the subsistence production in 2021 will be taken to be NZ$1,050,000.

[3] This equates to an annual per capita fish consumption of consumption of 200 kg.

## Locally based offshore catches

Based on the definition of locally based offshore fishing used in the present study[4], there is no locally based offshore fishing in Tokelau.

## Foreign-based offshore catches

To understand the situation of the foreign-based offshore catches, it is important appreciate that Tokelau has made tremendous progress in the last decade in managing the fishery. TFMA (2023) gives a chronology of the advancements (Box 26-1).

**Box 26-1:** A chronology of improvements to the management of the offshore fisheries

Over the last 10 years Tokelau has made major progress in its management of the foreign-based offshore fishery operating in its zone. This has included:

- Substantially exceeding the target annual revenue of US$6 million
- In 2011, securing recognition by WCPFC of 1000 annual purse seine vessel days for the Tokelau EEZ
- In 2012, becoming a participant in Purse Seine Vessel Day Scheme established under the Palau Arrangement
- In 2015, signing a long term arrangement with Papua New Guinea in relation to purse seine vessel days
- In 2016, joining Longline Vessel Day Scheme established under the Palau Arrangement, with an allocation of 5000 annual longline vessel days
- Playing a major role in the successful renegotiation of the US tuna treaty, with great benefits to the Pacific Island Parties and in particular Tokelau
- In 2016, joining with PNA members to secure MSC-certification for FAD-free tuna and establishing the Pacifical brand to market MSC-certified purse seine catch from PNA+ waters
- In 2018, fully establishing the Tokelau Fisheries Management Agency
- In 2019, becoming a participant in the FSM Arrangement for domestic fleets of PNA members
- In 2019, completion of updated regulatory framework
- In 2020, implemented minimum terms and conditions relating to labour standards on licensed fishing vessels.
- In 2020, signing a multi-year arrangement with Nauru in relation to purse seine vessel days.

[4] Industrial-scale tuna fishing operations that: (a) are based at a port in the relevant Pacific Island country; and (b) are generally harvested more than 12 nautical miles offshore.

According to the Tokelau Offshore Fisheries Management Plan (TFMA 2022), the components of Tokelau's offshore fisheries are:

- Purse seine activity in the Tokelau exclusive economic zone (EEZ) has been highly variable since 1990, although relatively consistent values of about 500–1,000 days have been fished since 2011 – but effort in the last 3 years has been somewhat lower. Vessels flagged to the United States, Korea and Kiribati account for the vast majority (> 90%) of fishing effort in the last 5 years. Very similar results are observed for annual catches, with catches in the last decade ranging between about 5,000 t and 45,000 t.
- Longline fishing activity in the Tokelau EEZ has also been variable over recent years. In some years, catches were almost negligible, although in the most recent five years, between 500 and almost 3,000 t of the three main tuna species have been caught. Vessels flagged to Kiribati, the Cook Islands and Vanuatu have accounted for most of this catch. The most important species in the catch is albacore, with moderate catches of yellowfin and bigeye also taken.

Table 26-2 gives the numbers and nationality of the vessels in Tokelau's offshore fisheries.

**Table 26-2:** Nationality and number of bilateral offshore licences issued in 2021

| Flag | Purse seine | Longline |
|---|---|---|
| Cook Islands | 0 | 6 |
| Kiribati | 7 | 0 |
| Korea | 18 | 0 |
| Philippines | 6 | 0 |
| Tuvalu | 3 | 0 |
| Vanuatu | 2 | 10 |
| Ecuador | 1 | 0 |
| **Total** | **37** | **16** |

Source: TFMA (2022)

Catches by the offshore vessels in recent years are given in Table 26-3.

**Table 26-3:** Recent annual catches by the foreign fleets in the Tokelau EEZ

| | | | Catch (t) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Gear | Effort (days) | Albacore | Bigeye | Skipjack | Yellowfin | Other | **Total** |
| 2016 | Longline | 4,077 | 2,247 | 462 | 0 | 770 | 387 | **3,866** |
| | Purse seine | 176 | 0 | 121 | 4,260 | 291 | 11 | **4,682** |
| 2017 | Longline | 2,169 | 1,424 | 158 | 0 | 408 | 264 | **2,254** |
| | Purse seine | 736 | 0 | 282 | 32,758 | 1,502 | 26 | **34,569** |
| 2018 | Longline | 993 | 595 | 54 | 0 | 148 | 78 | **875** |
| | Purse seine | 883 | 0 | 572 | 36,121 | 1,769 | 118 | **38,580** |
| 2019 | Longline | 1,727 | 1,387 | 126 | 0 | 318 | 289 | **2,120** |
| | Purse seine | 143 | 0 | 28 | 3,749 | 125 | 3 | **3,904** |
| 2020 | Longline | 2,983 | 1,218 | 166 | 0 | 585 | 326 | **2,295** |
| | Purse seine | 392 | 0 | 107 | 14,492 | 501 | 8 | **15,109** |
| 2021 | Longline | 1,029 | 360.56 | 78.24 | 0 | 289.68 | 104.29 | **1,870.78** |
| | Purse seine | 151.16 | 0 | 76 | 5,254.1 | 370 | 3.92 | **5,863.18** |

Source: TFMA (2022)

Some comment is required on the above table. For 2021, the catches given in the table appear substantially greater than that given by the Forum Fisheries Agency (FFA 2022b). Upon close inspection, it has become apparent that the total catches for 2021 for both longline and purse seine have not been added correctly, but rather the species catches have been added to the days of effort to obtain an incorrect total catch.

In view of the incorrect table, the approach taken in the present study is to use the data in FFA (2022b) to estimate the volume and value of the 2021 catches by foreign-based fleets in the Tokelau EEZ. In that document, estimates of the volumes and values of catches of the four main commercial species of tuna in the Western and Central Pacific Fisheries Commission (WCPFC) area for the years 1997–2021 are made by FFA using data sourced from SPC's Oceanic Fisheries Programme. The FFA data show that the total tuna catch made by foreign fleets in the Tokelau EEZ in 2021 was 1,004 t by longline and 4,440 by purse seine (5,444 t tuna total), with a total delivered value of US$11,790,506 (NZ$17,332,043).

The FFA data given in the paragraph above needs to be corrected for the in-zone value of the catch by subtracting transshipment costs (FFA data are the delivered value) and (for longlining) the bycatch (FFA data are only for the four main commercial species of tuna). This results in a total 2021 catch of 5,548 t, with an in-zone value of US$9,514,000 (NZ$13,986,000).

## Freshwater catches

There are no freshwater fisheries in Tokelau.

## Aquaculture harvests

There are currently no aquaculture activities in Tokelau.

## Summary of harvests

From the above sections, a crude approximation of the annual volumes and values of the fishery and aquaculture harvests in 2021 can be made (Table 26-4).

**Table 26-4:** Annual fisheries and aquaculture harvest in Tokelau in 2021

| Harvest sector | Volume (t) | Value (NZ$) |
|---|---|---|
| Coastal commercial | 0 | 0 |
| Coastal subsistence | 300 | 1,050,000 |
| Offshore locally based | 0 | 0 |
| Offshore foreign-based | 5,548 | 13,986,000 |
| Freshwater | 0 | 0 |
| Aquaculture | 0 | 0 |
| **Total** | **5,848** | **15,036,000** |

Figures 26-1 and 26-2 show the volumes and values of Tokelau fisheries production in 2021.

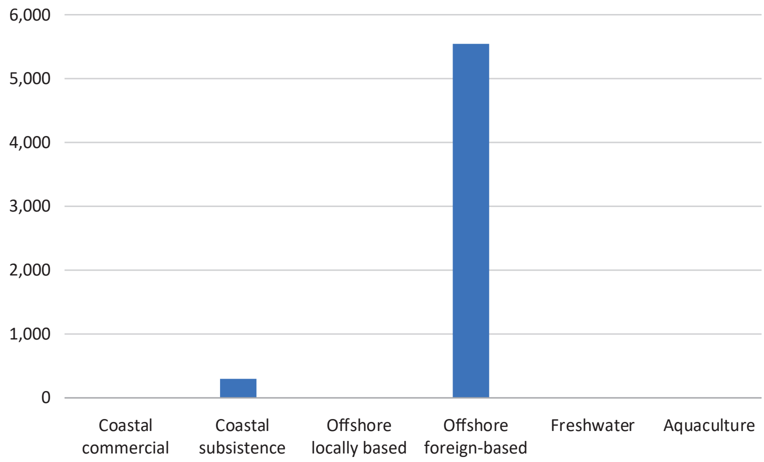



**Figure 26-1:** Tokelau fisheries production in 2021 by volume (t)

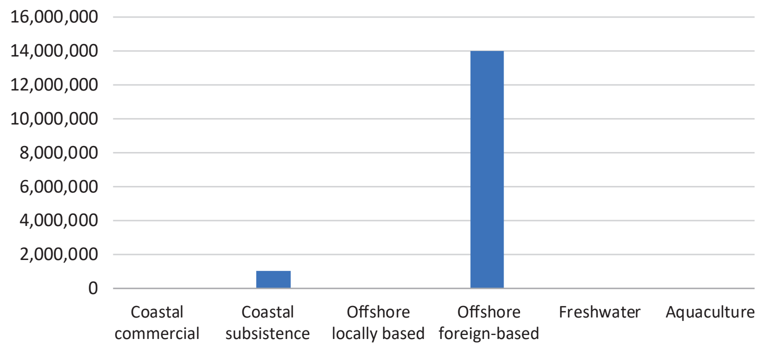



Figure 26-2: Tokelau fisheries production in 2021 by value (NZ$)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for Tokelau from those studies are provided in Table 26-5.[5]

[5] The earliest Benefish study (Gillett and Lightfoot 2001) did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 26-5: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Estimate year | Volume (t) | Nominal value (NZ$) |
|---|---|---|---|
| Coastal commercial | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 40 | 140,000 |
| | 2021 | 0 | 0 |
| Coastal subsistence | 1999 | n/a | n/a |
| | 2007 | 375 | 967,500 |
| | 2014 | 360 | 882,000 |
| | 2021 | 300 | 1,050,000 |
| Offshore locally based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Offshore foreign-based | 1999 | n/a | n/a |
| | 2007 | 318 | 540,484 |
| | 2014 | 24,286 | 42,500,000 |
| | 2021 | 5,548 | 13,986,000 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |

Source: The present study, Gillett (2106), Gillett (2009a), Gillett and Lightfoot (2001)

The apparent changes in production over the period covered by the studies sometimes represents a real change in production, but it can also reflect a change in the methodology used for measuring production (hopefully, an improvement) or new data becoming available. In the table above, coastal subsistence changes significantly between the years 2014 and 2021, but that is largely due to a realisation of the realities of per capita fish consumption, rather than a change in production. In contrast, changes in production figures in the table for the offshore fisheries (based on the availability of good quality data) likely reflect real changes in the amounts being harvested.

## 26.2 Contribution of fishing to GDP

### Current official contribution

According to the Tokelau National Statistician (K. Lui, per. com. October 2022), the last time work on the GDP of Tokelau was carried out was in 2017. The Tokelau Statistics website states:

> The Tokelau National Statistics Office has released the country's Gross Domestic Product figure for the first time. For the 2015/16 Financial Year (July–June), it was determined to be NZ$14 million. The tiny New Zealand non-self-governing territory Tokelau, situated about 500 km north of Samoa, counts 1,499 people. Given the importance of GDP, most countries calculate this economic indicator at least annually, if not quarterly. Until now, for Tokelau the only formal GDP estimate had been made around 1990. Unfortunately, that value remains quoted widely to this day (in Wikipedia, for example, from the CIA World Factbook 1993). A consultant expert to the Pacific Financial Technical Assistance Centre, Mr N David Hughes, has changed that dire situation. He has worked with Tokelau government departments in February/March 2017 to come up with the reliable, up-to-date value that is presented here (https://www.tokelau.org.nz/Bulletin/April+2017/GDP+first.html).

Table 26-6 provides the agriculture and fisheries contribution to the Tokelau GDP. Unfortunately, in the available information, fisheries cannot be disaggregated from agriculture.

**Table 26-6:** Agriculture and fisheries contribution to the Tokelau GDP (current prices, NZ$)

| | 2012/13 | 2013/14 | 2014/15 | 2015/16 |
|---|---|---|---|---|
| Gross output of agriculture and fishing | 526,977 | 529,547 | 558,155 | 569,800 |
| Intermediate consumption of agriculture and fishing | 231,643 | 232,773 | 245,348 | 250,467 |
| Value added of agriculture and fishing | 295,334 | 296,774 | 312,807 | 319,333 |
| Total GDP | 10,380,394 | 11,237,479 | 11,973,236 | 14,042,395 |
| Value added of agriculture and fishing as a % of GDP | 2.8% | 2.6% | 2.6% | 2.3% |

Source: https://www.tokelau.org.nz/Bulletin/April+2017/GDP

### Method used to calculate the official fishing contribution to GDP

The staff of the Tokelau National Statistics Office are unaware of the methodology used to determine the fishing contribution to GDP. On the National Statistics Office website, there is a note attached to the gross output of agriculture and fishing component of the GDP table stating: "The only available value is for 2015/16 from the HIES; other years are based on the change in the population and the price index."

### Alternative estimate of fishing contribution to GDP

Table 26-7 (below) represents one option for estimating fishing contribution to the GDP of Tokelau. It is a simplistic production approach that takes the values of two types of fishing activities for which production values were determined in Section 26.1 above (summarised in Table 26-4) and determines the value added by using value-added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

**Table 26-7:** Fishing contribution to Tokelau GDP in 2021

| Harvest sector | Gross value of production (NZ$, from Table 26-4) | VAR | Value added (NZ$) |
|---|---|---|---|
| Coastal commercial | 0 | 0 | 0 |
| Coastal subsistence | 1,050,000 | 0.80 | 840,000 |
| Offshore locally based | 0 | 0 | 0 |
| Freshwater | 0 | 0 | 0 |
| Aquaculture | 0 | 0 | 0 |
| **Total** | **1,050,000** | | **840,000** |

The above table indicates a 2021 fisheries contribution to GDP of NZ$840,000. This is substantially more than the NZ$569,800 estimated by Mr. Hughes for the GDP contribution of both agriculture and fisheries for the 2015/16 financial year.

## 26.3 Exports of fishery production

In some reports on Tokelau there is mention of small amounts of fishery exports:

- The 2015/16 HIES states that a small amount of income is generated from sales of stamps and commemorative coins. Other than that, there is no export of any significance from Tokelau. Some small-scale fish catches are sent to family in Samoa, and some solid waste is exported to Apia (NSO 2016).

- Tokelau does not export any foods and goods in quantifiable materials. An initial analysis in 2016 suggested that fish exports might amount to about 60 t per annum. However, this was an erroneous interpretation of the empty freezer containers returning to Apia, whose volume and weight were listed on the manifests as "fish". However, they had just a couple of bags of fish in them rather than being full, so could not further be quantified (Jasperse and Iose 2019).
- Commercial exploitation of sea cucumber and subsequent export occurred in Nukunonu in early 2012 (Pasilio et al. 2013).
- In the early 1990s there was an SPC-sponsored project to set up an export-oriented tuna jerky manufacturing operation in Tokelau (SPTO 1991).

The above points concern tiny amounts of exports from many years ago. The current situation is that there are no authorised fishery exports from Tokelau.

## 26.4 Government revenue from fisheries

### Access fees for offshore fishing

As stated above, the Tokelau paper for the 2022 meeting of the WCPFC Scientific Committee (TFMA 2022) indicates that in 2021 a total of 37 purse seiners and 16 longliners were licensed to fish in the Tokelau EEZ.

A complicating factor for portraying the access fees for offshore fishing in the Tokelau zone is a provision in the purse seine vessel day scheme which allows a participating country to both transfer and pool purse seine days to other participating countries, depending on where the purse seine fishing is concentrated. Consequently, the revenue earned by Tokelau from purse seining is not limited to fishing within the Tokelau EEZ.

The revenue earned by the Tokelau government from foreign-based offshore fishing is given in Table 26-8.

**Table 26-8:** Tokelau offshore fisheries revenue

| Year | Revenue (US$) |
|---|---|
| 2000–2010 (average) | 1.00 million |
| 2011 | 1.20 million |
| 2012 | 3.10 million |
| 2013 | 6.40 million |
| 2014 | 9.05 million |
| 2015 | 10.40 million |
| 2016 | 13.25 million |
| 2017 | 12.75 million |
| 2018 | 12.70 million |
| 2019 | 12.80 million |
| 2020 | 13.00 million |
| 2021 | 12.60 million |

Source: Tokelau Fisheries Management Agency (unpublished data)

Two points should be made about the above revenue:

- If total revenue (i.e. tax and non-tax revenue) of the Tokelau government in 2020[6] was NZ$37,841,000 (SPC/SDD), the US$12.6 million (NZ18.5 million) in the above table represents about 49% of the government revenue for that year.
- From a previous section on the foreign-based offshore catches above, the in-zone value of the catch of foreign-based vessels was about NZ$14.0 million in 2021. From the table immediately above, US$12.6 million (NZ$18.5 million) was earned by Tokelau in 2021 from offshore fisheries. Although it may appear that Tokelau is earning more money from foreign vessels than their catch is worth, the actual situation is explained above: the stated revenue earned in the table is made up of fees for fishing in the Tokelau zone and money earned from transferring/pooling some of Tokelau's purse seine vessel days.

## Other government revenue from fisheries

No documentation is available on non-access government revenue from the fisheries sector. The Director of Tokelau's Department of Economic Development, Natural Resources and Environment stated that the island administrations do not tax or license fishing activity (M. Perez, per. com. September 2015).

[6] The 2021 Tokelau government revenue is not yet available.

## 26.5 Fisheries-related employment

The 2015/16 Tokelau HIES contains information about participation in fisheries. The report of the survey (NSO 2016) indicates that 200 Tokelau households (80% of all households) participate in fisheries. This is an apparent decline from a survey carried out by SPC in 2003 in which 99.3% of all households reported participation in fisheries (Chapman et al. 2005).

In considering the importance of fisheries-related employment in Tokelau, the fact that there is no authorised commercial fishing is significant as it could reduce the pool of potential participants.

In many Pacific Island countries, the national census provides a significant amount of information on participation in fisheries. An examination of the 2016 Tokelau census report (NSO 2017) shows limited relevance to fisheries other than the statements: (a) males were much more likely than females to help with village fishing (59.4% compared with 3.0% for females) and (b) usual residents aged 40–49 years had the highest proportion of people who helped with village fishing (38.8%). All other mentions of fisheries in the census report were combined with other sectors to form the category of "labourers, agriculture, and fisheries workers", which reduces the relevance of the census for fisheries purposes. This feature is common in the census reports of Pacific Island territories that receive census technical assistance from metropolitan countries (where fisheries can be relatively unimportant), with other examples being American Samoa and the Northern Mariana Islands. This subject is further explored in the conclusions section of this study.

## 26.6 Levels of fishery resource consumption

Some of the historical studies of fishery resource consumption in Tokelau are:

- Gillett and Preston (1997) estimate that production from coastal fisheries in Tokelau in the early 1990s equated to an annual per capita fish supply of 119.4 kg (whole fish equivalent).
- Passfield (1998) indicates that the population of Fakaofo consumes an estimated average of 380 g of seafood per person per day. This equates to a total subsistence consumption of around 140 t per year (or 248 kg per capita per year, whole fish equivalent).
- In the 2016 Benefish study, Tokelau's 2014 coastal fishery production was estimated to be 400 t. "Frozen seafood" exports are shown in a section above to have been about 63 t in 2014, some of which would be semi-processed (e.g. headed/gutted). This equated to 279 kg/person/year. However, this does not equal the consumption rate, due to three factors: (1) the unknown amount of fish exported in dried form; (2) the

fish consumption by the large number of visitors to Tokelau in 2014, including those participating in the Catholic Church anniversary celebrations and the FFA meetings; and (3) any use of fish in Tokelau for uses not related to human consumption (e.g. bait, animal food, fertilizer).

The per capita consumption of fish on Tokelau would not be expected to be as high as that of the neighbouring atoll countries of Kiribati and Tuvalu where surveys have shown fish consumption up to 204 kg/year and 148 kg/year, respectively. This is due to the relative affluence of Tokelau and its strong bonds to New Zealand, facilitating the purchase of imported protein products. This idea is supported by an analysis of imports into Tokelau in 2014 (Jasperse 2015):

> Chicken leg quarters (54.1 tonnes) are the main form of protein purchased in 2014 in the store by far, supplemented by chicken wings (8.6 tonnes), corned beef (7.1 tonnes), salt beef (6.1 tonnes), lamb chops (5.7 tonnes), lamb necks (4.1 tonnes), mutton flaps (3.7 tonnes), and various types of sausages (13.4 tonnes). The presence of mackerel in oil (8.1 tonnes) and of tuna in oil (5.0 tonnes) is surprising given the large local fish catch.

Similar to above, the 2016 Tokelau HIES shows that "'Chicken (quarter leg)" is the top item consumed by households". However, that survey also states that "Fish (not specified)" is the top home-produced item consumed by households.

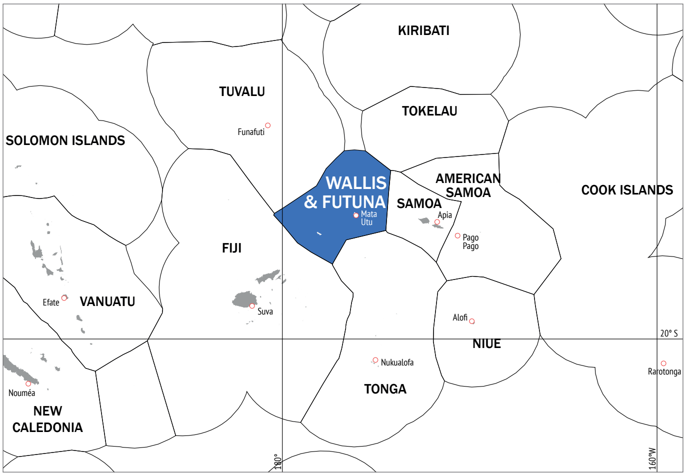
According to the Tokelau National Statistician, other than the HIES, there has not been recent work on fish consumption in Tokelau (K. Lui, per. com. October 2022).

## 26.7 Exchange rates

Tokelau uses the New Zealand dollar (NZ$). The average yearly exchange rates (NZ$ to the US dollar) used in this book are as follows:

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|
| 1.28 | 1.47 | 1.44 | 1.42 | 1.48 | 1.50 | 1.40 | 1.47 | 1.74 |

# 27 Wallis and Futuna




## 27.1 Volumes and values of fish harvests in Wallis and Futuna

### Coastal commercial catches in Wallis and Futuna

Box 27-1 provides a brief overview of fishing in Wallis and Futuna.

**Box 27-1:** Fishing in Wallis and Futuna

Fishing in Wallis and Futuna is an exclusively coastal activity, with almost all fishing effort focused on an area from the fringing reef to a few nautical miles offshore. Fishers generally do not use mechanised fishing gear. Most boats are small (4–6 m in length) and have outboard motors of between 15 and 80 hp. Very few fishers own a global positioning device or echo-sounder, and safety equipment is often lacking. Most people net fish (50%), underwater spearfish (44%), troll (21%) or handline (26%). Some 35% of fishers also collect shellfish and crustaceans. Taking all the techniques together, fishers tend to go out once or twice a week for periods varying from two to eight hours and targeting a very broad range of species. Professional fishers target more than 300 species of fish and invertebrates (Wallis Island is free from ciguatera), and about 30% of these catches consist of tunas and associated species.

The fisheries in the territory have undergone considerable change in recent years. In comparing the results between two surveys, the number of boats in Futuna was reduced from 56 in 2001 to 36 in 2014. The number of boats in Wallis was reduced from 252 in 2001 to 143 in 2014. Overall, there was a 42% decrease in the number of boats in the territory during the 13-year period.

Source: Jaugeon and Juncker (2021) and Sourd and Mailagi (2015)

There have been a number of historical attempts to review coastal fisheries in Wallis and Futuna. These include the following:

- Dalzell et al. (1996) used information from a 1994 report on the Wallis and Futuna economy and discussions with a fisheries officer to estimate a coastal commercial production of 296 tonnes (t), worth US$2,316,729, and a coastal subsistence production of 621 t, worth US$3,105,360.
- A detailed inventory of fishers, fishing gear and fishing practices of Wallis and Futuna was undertaken in 2001 (Fourmy 2002), but no catch estimates were made.
- Gillett (2009a) considered several types of information related to coastal fisheries in Wallis and Futuna, including the Dalzell et al. estimate (1996), a household income and expenditure survey carried out in Wallis and Futuna between June 2005 and May 2006 involving 1,025 households (Buffiere 2006) and fishery exports. The study concluded that in 2007, the production from coastal commercial fisheries in Wallis and Futuna was 121 t, which was worth XPF (Pacific Franc Exchange) 105 million.
- Gillett (2016) considered the above estimates, recent changes in population, evolution of the economy, the decline in the number of fishing boats, and estimated the coastal commercial fisheries production of Wallis and Futuna in 2014 to be 150 t, worth XPF 150 million.

Because the territory was to some degree isolated from the rest of the world during the first part of the pandemic, the first case of Covid in the territory did not occur until March 2021 (IEOM 2022b). This isolation caused some food shortages, creating at least some incentive for increasing fishing activity. However, according to the staff of Direction des Services de l'agriculture, de la forêt et de la pêche (DSA), Covid had a "detectable but minor impact on fisheries".

There are several indications that fisheries in Wallis and Futuna have declined in importance in the last few decades. In its annual economic report on Wallis and Futuna for 2021 (IEOM 2022b), the Institut d'Émission d'Outre-mer cites the 2019/20 household income and expenditure survey that showed that in 2006, 35% of households in the territory were involved in subsistence fishing, but this dropped to 9% in 2019/20. According to the staff of DSA, the total number of fishers (commercial and subsistence) was about 2,000 in 2014, but in 2021 it was closer to 200. Changes in dietary preferences and an increase in cash income have resulted in a drop in fish consumption. According to Pacific Community (SPC) Statistics for Development Division (SDD) data, the population of the territory declined from 12,250 in 2014 to 11,369 in 2021. Anon. (2022b) states that the territory lost 22% of its population between 2003 and 2018.

In the past few years, there has been an increase in the amount of information available on the fisheries production of Wallis and Futuna. Data are available from the 2019 household income and expenditure survey, and there is monitoring of the landings of professional fishers[1] and their logbooks. This and other information have enabled the compilation of Tables 27-1 and 27-2 giving the volume and value of catches.

**Table 27-1:** Volume of catches by year and species group (t)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Misc. marine finfish | 170 | 206 | 240 | 262 | 231 | 231 |
| Tunas | 9 | 7 | 17 | 27 | 12 | 12 |
| Coconut crab | 0 | 0 | 0 | 0 | 7 | 7 |
| Other aquatic invertebrates | 0 | 0 | 0 | 0 | 7 | 7 |
| Marine crabs | 1 | 1 | 1 | 1 | 2 | 2 |
| Octopus, squid | 1 | 1 | 1 | 1 | 2 | 2 |
| Freshwater fish | 0 | 0 | 0 | 0 | 1 | 1 |
| Lobsters | 1 | 1 | 1 | 1 | 1 | 1 |
| Pacific oysters | 0 | 0 | 0 | 0 | 1 | 1 |
| Sea cucumbers | 0 | 0 | 0 | 0 | 0 | 0 |
| Giant clam | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **182** | **216** | **260** | **292** | **264** | **264** |

Source: Modified from a spreadsheet prepared by Service de la pêche et de gestion des ressources marines for submission to FAO.

[1] Jaugeon and Juncker (2021) provide some information on what a "professional fisher" is in Wallis and Futuna. A regulation in 2005 created the legal basis for a professional fisher. Registration as a professional fisher is not an authorisation to fish, but it makes a fisher eligible to sell fish and to receive government subsidies, such as assistance fuel, gear and training – but it also places an obligation on a fisher to register his/her vessel, provide catch data and use sea safety gear.

Table 27-2: Value of the 2021 Catch

| | 2021 catch volume (t) | 2021 catch value (XPF per kg) | Total value per species group (XPF) |
|---|---|---|---|
| Misc. marine finfish | 231 | 816 | 188,496,000 |
| Tunas | 12 | 1138 | 13,656,000 |
| Coconut crab | 7 | 1473 | 10,311,000 |
| Other aquatic invertebrates | 7 | 635 | 4,445,000 |
| Marine crabs | 2 | 1367 | 2,734,000 |
| Octopus, squid | 2 | 1424 | 2,848,000 |
| Freshwater fish | 1 | 200 | 200,000 |
| Lobsters | 1 | 2113 | 2,113,000 |
| Pacific oysters | 1 | 1500 | 1,500,000 |
| **Total** | **264** | ---- | **226,303,000** |

Source: Modified from a spreadsheet prepared by Service de la pêche et de gestion des ressources marines for submission to FAO.

The above tables give the volumes and values of all fisheries in Wallis and Futuna which, with the exception of 1 t of freshwater fish, equates to coastal fisheries. For the purposes of the present study, the coastal fisheries need be divided into coastal commercial fisheries and coastal subsistence fisheries. To do so, the difference in the disposal of fish (i.e. what determines if a fish is commercial or subsistence) between Wallis and that of Futuna need to be recognised. The 2021 Annual Report of the Coastal Fisheries Observatory (Anon. 2022a) cites a study that separates the disposal of fish into three categories (Table 27-3). Categories #1 and #2 in the table constitute "subsistence" in the present study.

Table 27-3: Disposal of fish on Wallis and Futuna

| | Wallis | Futuna |
|---|---|---|
| 1. Fish given away | 28% | 41% |
| 2. Fish for home consumption | 50% | 53% |
| 3. Fish for sale | 22% | 6% |

The 2021 Annual Report also states that in 2021 the production of professional fishers on Wallis was 23.6 t, and on Futuna it was 11.3 t (35.1 t total; 13% of the 264-t total). However, it is likely that there were sales by people not registered as professional fishers.

For the purposes of the present study, it will be assumed that about 16% of all the coastal fisheries production (i.e. 42 t) is sold. From the value information in Table 27-2 (above) and using the farm gate method for valuing subsistence production, it can be crudely estimated that the coastal commercial fisheries production of Wallis and Futuna is worth XPF 48 million to the fishers (i.e. 42 t at XPF 1,147 per kg).

### Coastal subsistence catches

Following the logic presented above, the 2021 Wallis and Futuna coastal subsistence catch is estimated to be 221 t. Using the farm gate method for valuing subsistence production (i.e. 70% of the commercial value), this production is worth about XPF 177.4 million.

### Locally based offshore catches

Although there is some trolling from small boats outside the reef for tuna and other pelagics, this is considered to be coastal fishing for the purposes of the present study. There is currently no locally based offshore fishing in Wallis and Futuna.

The last locally based longliner operated for about two years, starting in 2010 (B. Mugneret, per. com. January 2023).

### Foreign-based offshore catches

There is currently no authorised foreign fishing in the Wallis and Futuna zone. The last foreign fishing activity occurred in 1999 (Service de la Pêche et de l'Aquaculture 2007). Discussions with American purse seiners opened in 2014 were suspended soon thereafter (Mugneret and Jaugeon 2019).

### Freshwater catches

There is only a tiny amount of freshwater fishing in Wallis and Futuna. Tilapia has been introduced into freshwater bodies on Wallis (Hinds 1969), but it is not considered a food fish. There is some freshwater shrimp captured in the streams of Futuna.

Table 27-2 (above) estimates the production from freshwater fisheries to be 1 t, worth XPF 200,000.

### Aquaculture Production

Although there have been some aquaculture trials on Wallis (e.g. *Macrobrachium* [Nandlal 2005]), there is currently no aquaculture production in the territory (B. Mugneret, per. com. January 2023).

## Summary of harvests

A crude approximation of the annual volumes and values of the fisheries and aquaculture production in Wallis and Futuna in 2021 is given in Table 27-4.

Table 27-4: Annual fisheries and aquaculture harvest in Wallis and Futuna in 2021

| Harvest sector | Volume (t) | Value (XPF) |
|---|---|---|
| Coastal commercial | 42 | 48,000,000 |
| Coastal subsistence | 221 | 177,400,000 |
| Offshore locally based | 0 | 0 |
| Offshore foreign-based | 0 | 0 |
| Freshwater | 1 | 200,000 |
| Aquaculture | 0 | 0 |
| **Total** | **264** | **225,600,000** |

Figures 27-1 and 27-2 show the volumes and values of Wallis and Futuna fisheries production in 2021.

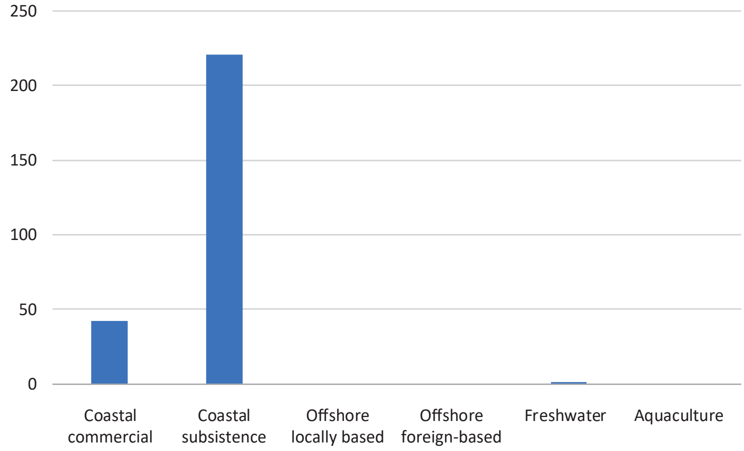



**Figure 27-1:** Wallis and Futuna fisheries production in 2021 by volume (t)

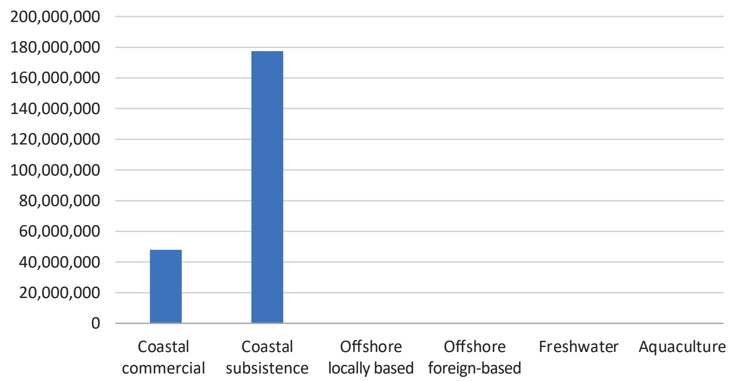



**Figure 27-2:** Wallis and Futuna fisheries production in 2021 by value (XPF)

## Past estimates of fishery production levels by the Benefish studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries (the "Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The fishery production levels for Wallis and Futuna from those three studies are given in Table 27-5.

Table 27-5: Estimates by the Benefish studies of annual fisheries/aquaculture harvests

| Harvest sector | Year | Volume (t) | Nominal value (XPF) |
|---|---|---|---|
| Coastal commercial | 1999 | n/a | n/a |
| | 2007 | 121 | 105,000,000 |
| | 2014 | 150 | 150,000,000 |
| | 2021 | 42 | 48,000,000 |
| Coastal subsistence | 1999 | n/a | n/a |
| | 2007 | 840 | 551,000,000 |
| | 2014 | 675 | 641,250,000 |
| | 2021 | 221 | 177,400,000 |
| Offshore locally based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Offshore foreign-based | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Freshwater | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 1 | 200,000 |
| Aquaculture | 1999 | n/a | n/a |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |

Source: The present study, Gillett (2016), Gillett (2009a), Gillett and Lightfoot (2001)

## 27.2 Contribution of fishing to GDP

### Current official contribution

In its annual economic report on Wallis and Futuna for 2021 (IEOM 2022b), the Institut d'Émission d'Outre-mer gives information on the GDP in the territory. It is stated there is no government agency in Wallis and Futuna with responsibility for calculating GDP. A Paris-based entity, Comptes Économiques Rapides pour l'Outre-Mer, did work on the GDP of the territory in 2008, which resulted in a GDP estimate for Wallis and Futuna in 2005 of XPF 18 billion. The IEOM report indicate that no other estimation of GDP for the territory has been done since that for 2005.

### Method used to calculate the official fishing contribution to GDP

Information about the method used to calculate the Wallis and Futuna GDP is not readily available. Interviews in 2015 with the Service Territorial de la Statistique indicated the staff were unaware of how the GDP estimate was made and whether it considered fishing.

### Estimate of fishing contribution to GDP

Table 27-6 (below) represents one option for estimating fishing contribution to GDP in Wallis and Futuna. It is a simplistic production approach that takes the values of five types of fishing/aquaculture activities for which production values were determined in the sections above (summarised in Table 27-4) and determines the value added by using value-added ratios that are characteristic for the type of fishing concerned. Those VARs were determined through knowledge of the fisheries sector and by using specialised studies (Appendix 3).

**Table 27-6:** Fishing contribution to the Wallis and Futuna GDP in 2021

| Harvest sector | Gross value of production (XPF, from Table 27-4) | VAR | Value added (XPF) |
|---|---|---|---|
| Coastal commercial | 48,000,000 | 0.65 | 31,200,000 |
| Coastal subsistence | 177,400,000 | 0.80 | 141,920,000 |
| Offshore locally based | 0 | 0 | 0 |
| Freshwater | 200,000 | 0.90 | 180,000 |
| Aquaculture | 0 | 0 | 0 |
| **Total (XPF)** | **225,600,000** | --- | **173,300,000** |

It is not possible to determine the percentage of the GDP of Wallis and Futuna that this XPF 173.3 million represents – the above table is for 2021, while the latest year for which the GDP has been calculated is 2005. Gillett (2009a) stated that the contribution of fishing to GDP in 2007 estimated in the study (XPF 50 million) represented 2.8% of the GDP of Wallis and Futuna in 2005.

## 27.3 Exports of fishery production

There were no significant fishery exports of Wallis and Futuna in 2021.

In the past, there were occasionally exports of trochus and sea cucumbers. According to the staff of DSA, the last trochus exported was less than a container load just before the Covid period. The last export of cucumbers was about 2011 or 2012. Since 2015, there has been a ban on the export of sea cucumbers, which was an initiative of the Territorial Environment Service (B. Mugneret, per. com. January 2023)

## 27.4 Government revenue from fisheries

### Access fees for foreign fishing

Since 1999, there have been no access agreements with foreign fishing fleets (Service de la Pêche et de l'Aquaculture 2007). Consequently, no access fees for foreign fishing have been received since that time. There are no access fees for any domestic vessels.

### Other government revenue from fisheries

In Wallis and Futuna, the fishing sector is not revenue generating, but rather is subsidy absorbing. According to Anon. (2022b), there are two main types of subsidies in the fisheries sector:

- Investment assistance. This is for boats, fishing and other gear, and processing equipment. In 2021 XPF 9.5 million of such assistance was distributed on Wallis and XPF 4.3 million on Futuna.
- Fuel assistance. This assistance covers up to 60% of the fuel used in fishing. In 2021 there were 23 beneficiaries of this assistance, with XPF 2.6 million distributed on Wallis and XPF 1.5 million on Futuna.

## 27.5 Fisheries-related employment

A report by the Coastal Fisheries Observatory of Wallis and Futuna (Anon. 2022a) contains information on fisheries-related employment:

- In 2021 there were 28 professional fishers on Wallis and eight on Futuna.
- Among the professional fishers cited in the point above, there is one female on Wallis and one on Futuna
- The average age of a professional fisher is 49 years, with a range from 16 to 65.

As mentioned in a section above, there are several indications that fisheries in Wallis and Futuna have declined in importance in the last few decades. In its annual economic report on Wallis and Futuna for 2021 (IEOM 2022b), the Institut d'Émission d'Outre-mer cites the 2019–2021 household income and expenditure survey that showed that in 2006, 35% of households in the territory were involved in subsistence fishing, but this dropped to 9% in 2019/20. According to the staff of DSA, the total number of fishers (professional and subsistence) was about 2,000 in 2014, but in 2021 it was closer to 200.

## 27.6 Levels of fishery resource consumption

Historical attempts to estimate per capita fish consumption on Wallis include:

- Gillett and Preston (1997) considered fishery production in Wallis and Futuna along with the territory's fishery imports/exports to estimate an annual per capita fish supply of 66.9 kg for the period of the early 1990s.
- Bell et al. (2009b) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The surveys were designed to enumerate consumption based on both subsistence and cash acquisitions. The household income and expenditure survey carried out in Wallis and Futuna between June 2005 and May 2006 (Buffiere 2006) was used to determine that the annual per capita fish consumption (whole weight equivalent) in Wallis and Futuna was 74.6 kg, of which 98% was fresh fish.
- Gillett (2016) estimated the 2014 coastal fisheries production (subsistence and commercial) to be 825 t. This equates to 68.7 kg of fish per capita across the Wallis and Futuna population of 12,011. This figure does not consider imports of fishery products.
- IEOM (2022b) states that the per capita fish consumption in Wallis and Futuna in 2020 was between 23 and 27 kg annually, compared to 75 kg in 2006.

The report of the 2020 Wallis and Futuna household income and expenditure survey (SPC, STSEE 2022) gives the consumption frequency of the main fishery products (Table 27-7). That report also states that in 2006, 17% of households reported eating fresh fish. Fourteen years later, the percentage of households doing so dropped to 5%.

**Table 27-7:** Frequency of consuming fishery products in 2020

| Product | Origin of product | Percentage of households that reported consuming the product in the last 14 days |
|---|---|---|
| Other fish | Local | 22% |
| Lagoon fish | Local | 20% |
| Shrimp | Imported | 3% |
| Coconut crab | Local | 2% |
| Mussels | Imported | 2% |
| Canned fish | Imported | 1% |
| Tuna (fresh, frozen) | Local | 1% |
| Preparations of fish | Imported | 1% |
| Trochus | Local | 1% |
| Lobster | Local | 1% |
| Marine crabs | Local | 0% |
| Cooked mussels | Imported | 0% |

Source: SPC, STSEE (2022)

Futuna has a higher per capita fishery product consumption rate than Wallis, 34.6 kg vs 19.4 kg, respectively. This equates to a consumption rate for the two islands of 27 kg per resident per year, a considerable drop from 75 kg per resident per year in 2006 (DSA 2022).

## 27.7 Exchange rates

The average yearly exchange rates (XPF to the US dollar) used in this book are as follows:

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 89.88 | 86.01 | 98.13 | 108.81 | 114.17 | 99.42 | 104.39 | 106.78 | 98.00 | 105.37 | 120.27 |

# 28 International Waters

## 28.1 Volumes and values of fish harvests in international waters

Currently, 11 different bodies of international water in the western and central Pacific Ocean (WCPO) are documented in Pacific Community (SPC) and Forum Fisheries Agency (FFA) statistics. The codes for those areas and descriptions are given in Table 28-1, and the areas are shown in Figure 28-1.

**Table 28-1:** International waters in the central and western Pacific Ocean

| Code | Description |
|---|---|
| I1 | Doughnut hole between Papua New Guinea and Federated States of Micronesia |
| I2 | Doughnut hole between FSM, Solomon Islands, Kiribati, Marshall Islands, Nauru andTuvalu |
| I3 | International waters east of the Philippines to Guam, above FSM, around Marshall Islands, up to 20°N and west of 175°E (not including areas I1, I2 and I8) |
| I4 | International waters east of Marshall Islands and Kiribati, from the equator up to 20°N and east of 175°E to 170°W |
| I5 | International waters around Line Group from the equator up to 20°N, east of 170°W to 150°W, and south of the equator to 20°S from 155°W-130°W |
| I6 | The remaining international waters not covered above in the Northern Hemisphere of the WCPFC area |
| I7 | The remainder of international waters not covered above in the Southern Hemisphere of the WCPFC area |
| I8 | International waters bordered by Fiji, Solomon Islands and Vanuatu |
| I9 | International waters between Cook Islands and French Polynesia |
| H4 | International waters between Tuvalu, Phoenix and Tokelau, from the Equator down to 10°S and east of 175°E to 170°W |
| H5 | International waters between Phoenix and Line Groups, from the Equator down to 10°S, east of 170°W to 155°W (excludes International Waters between Cook Islands and French Polynesia = Area "I9") |

Source: FFA (2022b)

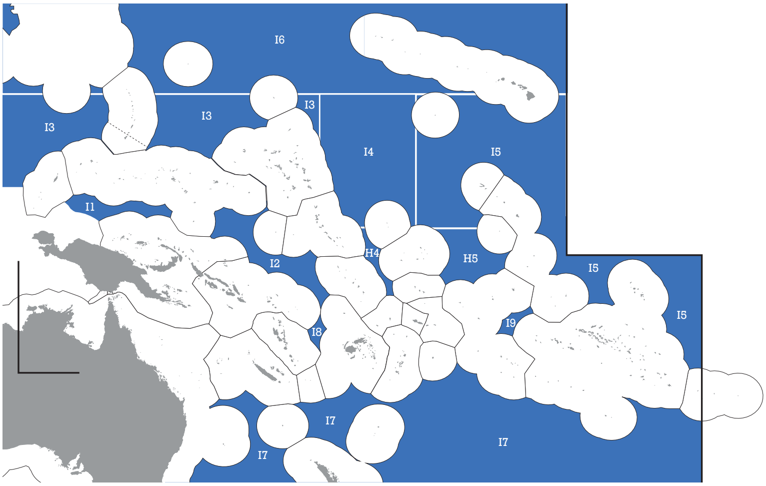



**Figure 28-1:** The 11 Bodies of International Waters in the WCPO
Source: SPC, Oceanic Fisheries Programme; Key: Refer to Table 28-1

Estimates of the volumes and values of catches of the four main commercial species of tuna in the Western and Central Pacific Fisheries Commission area for the years 1997–2021 have been made by FFA (2022b) using data sourced from SPC's Oceanic Fisheries Programme. The following should be noted with respect to these data:

- The FFA/SPC prices are all "delivered" prices in that they reflect the price received at entry to the country in which they are usually sold, whether for processing or consumption.
- Bycatch represents an important aspect of the volume – and sometimes the value – of offshore longline fisheries, but bycatch is not included in the FFA estimate.

Estimates of the volume and value of the catches in international waters are given in Tables 28-2 and 28-3 below. The figures presented have been modified from FFA (2022b) to reflect bycatch and the "in-zone" value.

Table 28-2: Volume of catches in international waters

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Purse seine volume (t) | 197,850 | 293,862 | 220,667 | 157,058 |
| Longline volume corrected for bycatch (t) | 139,333 | 156,956 | 131,414 | 109,884 |
| Pole and line volume (t) | 82,267 | 80,790 | 45,584 | 64,992 |
| Trolling volume (t) | 535 | 1,086 | 2,103 | 842 |
| Other gear volume (t) | 133 | 136 | 136 | 136 |
| **Total** (t) | **420,118** | **532,830** | **399,904** | **332,912** |

Source: SPC Oceanic Fisheries Programme (unpublished data)

Table 28-3: Value of catches in international waters

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Purse seine value (US$) | 239,398,500 | 355,573,020 | 267,007,070 | 90,040,180 |
| Longline value corrected for bycatch (US$) | 887,830,744 | 932,941,578 | 763,383,926 | 691,060,476 |
| Pole and line value (US$) | 139,853,900 | 137,343,000 | 77,492,800 | 110,486,400 |
| Trolling value (US$) | 1,712,000 | 3,475,200 | 6,729,600 | 2,694,400 |
| Other gear value (US$) | 199,500 | 204,000 | 204,000 | 204,000 |
| **Total** (US$) | **1,268,994,644** | **1,429,536,798** | **1,114,817,396** | **894,485,456** |

Source: Table 28-2 above, FFA (2022b) and consult

In 2021 longlining was responsible for 77.3% of the value of catch by all gear types in the international waters of the WCPO. According to FFA (2022b), in 2021, the areas I4 and I5 in the above figure were responsible for over half of the value of the longline catch in international waters of the WCPO.

# 29 Fisheries and Aquaculture Production Levels

## 29.1 Summary information

Information on the volumes and values of fishery production for each country and territory is given in the country and territory chapters. Summary information is given in Tables 29-1 and 29-2 (below).

The values reflect the prices paid to the producer – either dockside prices, prices at first sale or (for aquaculture) farm gate prices. For subsistence fishing, the farm gate method of valuing subsistence production is used.[1] For offshore fishing, an analogous system is used in which the readily available world market prices for the fishery commodities are discounted by an amount to cover transport of the commodities to those markets.

In the tables below, aquaculture production is kept separate from the other fishery categories because the volume in several countries is expressed in both tonnes (t) (e.g. for seaweed) and pieces (e.g. for giant clams, coral and sometimes pearls).

[1] The farm gate pricing method uses the market price of the product less the cost of getting that product to market (Bain 1996). In effect, it is indicating that the value of self-consumption is equivalent to the price the product could be sold for in the market, less the cost of getting the product to market.

**Table 29-1:** Volume of production in 2021

| | Coastal commercial | Coastal subsistence | Offshore locally based | Offshore foreign-based | Freshwater | Total | Aquaculture | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | t | Pieces |
| Cook Islands | 150 | 280 | 100 | 4,621 | 5 | **5,156** | 0 | 81,500 |
| FSM | 1,600 | 3,400 | 153,578 | 92,899 | 1 | **251,478** | 0 | 65,000 |
| Fiji | 11,700 | 18,400 | 10,828 | 0 | 4,000 | **44,928** | 351 | 20,000 |
| Kiribati | 8,000 | 11,000 | 2,686 | 349,345 | 0 | **371,031** | 2 | 0 |
| Marshall Islands | 1,200 | 3,000 | 91,167 | 42,514 | 0 | **137,881** | 2.3 | 22,000 |
| Nauru | 140 | 100 | 111,821 | 136,893 | 0 | **248,954** | 0.1 | 0 |
| Niue | 9 | 160 | 0 | 0 | 0 | **169** | 0 | 0 |
| Palau | 1,000 | 1,400 | 41 | 1,315 | 1 | **3,757** | 11 | 4,419 |
| PNG | 6,000 | 40,000 | 170,755 | 161,133 | 23,000 | **400,888** | 850 | 10,000 |
| Samoa | 5,500 | 5,500 | 1,001 | 0 | 10 | **12,011** | 6.5 | 10,000 |
| Solomon Islands | 5,000 | 25,000 | 50,597 | 62,234 | 2,500 | **145,331** | 3,150 | 0 |
| Tonga | 3,500 | 3,500 | 290 | 1,759 | 1 | **9,050** | 0 | 35,000 |
| Tuvalu | 350 | 1,150 | 0 | 71,817 | 2 | **73,319** | 0 | 0 |
| Vanuatu | 1,300 | 3,100 | 1,000 | 2,320 | 88 | **7,808** | 8 | 4,000 |
| American Samoa | 15 | 100 | 994 | 0 | 1 | **1,110** | 10 | 0 |
| French Polynesia | 3,565 | 2,350 | 6,405 | 0 | 100 | **12,420** | 1,542 | 8,574,012 |
| Guam | 26 | 30 | 0 | 0 | 3 | **59** | 100 | 0 |
| New Caledonia | 680 | 4,760 | 2,625 | 0 | 10 | **8,075** | 1,538 | 0 |
| Northern Mariana Islands | 183 | 204 | 0 | 0 | 0 | **387** | 2.3 | 0 |
| Pitcairn | 3 | 6 | 0 | 0 | 0 | **9** | 0 | 0 |
| Tokelau | 0 | 300 | 0 | 5,548 | 0 | **5,848** | 0 | 0 |
| Wallis & Futuna | 42 | 221 | 0 | 0 | 1 | **264** | 0 | 0 |
| **Total** | **49,963** | **123,961** | **603,888** | **932,398** | **29,723** | **[see next paragraph]** | **7,573** | **8,825,931** |

Source: The harvest summary table in each country chapter Units: Tonnes, unless pieces are specified

Table 29-2: Value of production in 2021 (US$)

| | Coastal commercial | Coastal subsistence | Offshore locally based | Offshore foreign-based | Freshwater | Aquaculture | Total |
|---|---|---|---|---|---|---|---|
| Cook Islands | 1,088,435 | 1,564,626 | 1,700,680 | 10,680,272 | 27,891 | 224,830 | **15,286,735** |
| FSM | 7,000,000 | 10,500,000 | 205,600,000 | 121,100,000 | 8,000 | 325,000 | **344,533,000** |
| Fiji | 27,358,491 | 37,735,849 | 39,905,660 | 0 | 3,301,887 | 2,836,792 | **111,138,679** |
| Kiribati | 22,463,768 | 21,739,130 | 12,723,775 | 435,798,043 | 0 | 7,246 | **492,731,963** |
| Marshall Islands | 3,400,000 | 6,000,000 | 121,000,000 | 60,966,870 | 0 | 85,500 | **191,452,370** |
| Nauru | 1,115,942 | 557,971 | 135,303,409 | 165,640,530 | 0 | 725 | **302,618,577** |
| Niue | 91,837 | 1,142,857 | 0 | 0 | 0 | 0 | **1,234,694** |
| Palau | 5,510,000 | 5,399,800 | 395,250 | 10,968,872 | 10,000 | 89,000 | **22,372,922** |
| PNG | 18,803,419 | 79,772,080 | 204,843,305 | 208,547,009 | 36,752,137 | 3,418,803 | **552,136,752** |
| Samoa | 22,393,822 | 15,444,015 | 3,976,834 | 0 | 28,378 | 41,506 | **41,884,556** |
| Solomon Islands | 9,937,888 | 40,372,671 | 79,149,193 | 78,483,106 | 4,223,602 | 1,956,522 | **214,122,982** |
| Tonga | 14,561,404 | 10,219,298 | 1,491,228 | 9,605,263 | 2,917 | 438,596 | **36,318,706** |
| Tuvalu | 1,141,304 | 2,041,667 | 0 | 90,341,870 | 1,449 | 0 | **93,526,291** |
| Vanuatu | 6,898,382 | 9,595,826 | 2,264,084 | 8,923,676 | 294,508 | 45,989 | **28,022,464** |
| American Samoa | 105,000 | 490,000 | 3,000,000 | 0 | 4,900 | 49,000 | **3,648,900** |
| French Polynesia | 20,860,776 | 9,625,800 | 42,084,085 | 0 | 415,678 | 55,487,596 | **128,471,800** |
| Guam | 150,959 | 176,400 | 0 | 0 | 12,000 | 433,000 | **772,359** |
| New Caledonia | 4,975,609 | 24,380,488 | 17,519,218 | 0 | 51,220 | 19,815,887 | **66,742,422** |
| Northern Mariana Islands | 1,175,803 | 915,960 | 0 | 0 | 0 | 16,250 | **2,108,013** |
| Pitcairn | 18,367 | 14,286 | 0 | 0 | 0 | 0 | **32,653** |
| Tokelau | 0 | 714,286 | 0 | 9,514,286 | 0 | 0 | **10,228,571** |
| Wallis and Futuna | 455,538 | 1,683,591 | 0 | 0 | 1,898 | 0 | **2,141,027** |
| **Total** | **169,506,744** | **280,086,601** | **870,956,721** | **1,210,569,797** | **45,136,465** | **885,272,242** | **[see next paragraph]** |

Source: The harvest summary table in each country chapter Units: US$

To compile the regional totals for the six fishery categories, an adjustment needs to be made. "Offshore foreign-based" is by geographic zone, whereas "offshore locally based" is by fleet. Double counting can occur because the catch by a Pacific Island fleet in the zone of another Pacific Island country is counted both as "offshore locally based" in the home country of the fleet and as "offshore foreign-based" in the country where the catch is made. The Forum Fisheries Agency (FFA) spreadsheet (FFA 2022b) can be used to estimate the adjustment that needs to be made to avoid this double counting.[2]

As detailed in the footnote below, the amount in the final point needs to be adjusted for "national fleets" that are not actually based in an FFA member country. The result of these calculations is an approximation of the volume of offshore catches by vessels based in Pacific Island countries in the zones of other Pacific Island countries. Expressed as a correction in percentage of volume, in 2021 the combined volume of "locally based offshore" and "foreign-based offshore" must be reduced about 12% to avoid double counting. Expressed as a percentage of value, in 2021 the combined value of "locally based offshore" and "foreign-based offshore" must be reduced by an estimated 8% to avoid double counting. The difference between the volume and value corrections is because most of the potentially double counted catch is from purse seiners, whose catch is less valuable per tonne than that of longliners. In Tables 29-3 and 29-4 below, these corrections are applied, enabling regional estimates.

**Table 29-3:** Regional volume of fishery production by category in 2021 (t)

| | Coastal commercial | Coastal subsistence | Offshore | | Freshwater | Regional volume total |
|---|---|---|---|---|---|---|
| | | | Offshore locally based | Offshore foreign-based | | |
| **Totals** | **49,963** | **123,961** | **603,888** | **932,398** | **29,723** | ----- |
| Totals adjusted for duplicate offshore fishing | 49,963 | 123,961 | 1,351,932 | | 29,723 | 1,555,579 |

Note: Table does not include aquaculture due to difference in units (t and pieces);
Source: Table 29-1, FFA (2022b) and C. Reid (per. com. March 2023)

2 In the FFA (2022) spreadsheet:
Sheet 8 = catches by national fleets in their own waters
Sheet 9 = catches by national fleets in FFA members' waters
Sheet 8 minus Sheet 9 = catches of a national fleets in other FFA member waters

**Table 29-4:** Regional value of fishery production by category in 2021 (US$)

| | Coastal commercial | Coastal subsistence | Offshore | | Freshwater | Aquaculture | Regional value total |
|---|---|---|---|---|---|---|---|
| | | | Offshore locally based | Offshore foreign-based | | | |
| **Totals** | **169,506,744** | **280,086,601** | **870,956,721** | **1,210,569,797** | **45,136,465** | **85,272,242** | **---** |
| Totals adjusted for duplicate offshore fishing | 169,506,744 | 280,086,601 | 1,915,004,397 | | 45,136,465 | 85,272,242 | 2,495,006,449 |

Source: Table 29-2, FFA (2022b) and C. Reid (per. com. March 2023)

The total fishery and aquaculture production of the zones of the 22 Pacific Island countries and territories in 2021 is estimated to be about 1.56 million t[3], worth about US$2.5 billion. Noting that there are different "regions" for fishery purposes in this part of the world, if the 11 bodies of international waters adjacent to Pacific Island countries are included (see section above on international waters), then the totals increase to 1.89 million t and US$3.39 billion.

In the paper prepared for the 2022 meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC) titled "Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions – 2021" (Williams and Ruaia 2022), the volume and value of the offshore tuna fisheries of the WCPFC statistical area are given for 2021: 2,493,571 t and $4.6 billion. This is much more than the present study's estimate (above) due to the Williams and Ruaia (2022) estimate (a) covering a much larger geographic area (including the waters of some Asian countries) and (b) using delivered values instead of the in-zone values used by the present study.

The composition of the fishery production in each country is quite different. The four figures below show the volumes and values by fishery category for each country, with the countries placed in two groups (higher producing and lower producing) so that the figures for the lower-producing countries are discernible. More detailed information on each country is presented in the country and territory chapters.

3 Plus 7,573 t and 8,825,931 pieces for aquaculture.

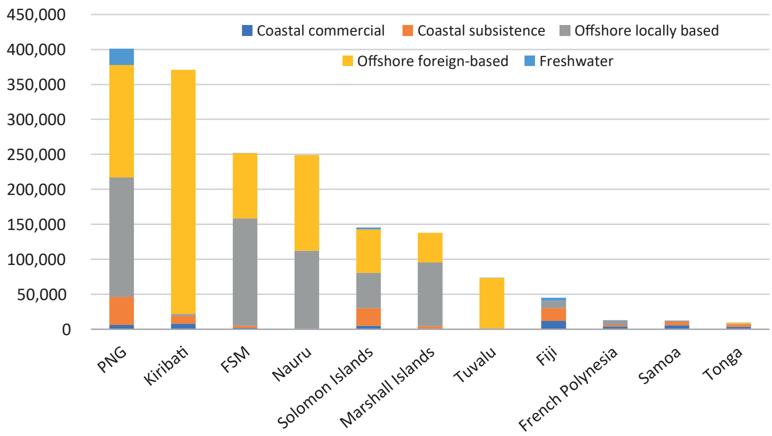



**Figure 29-1:** Volume of fishery production by category in the higher-producing countries/territories in 2021 (t)

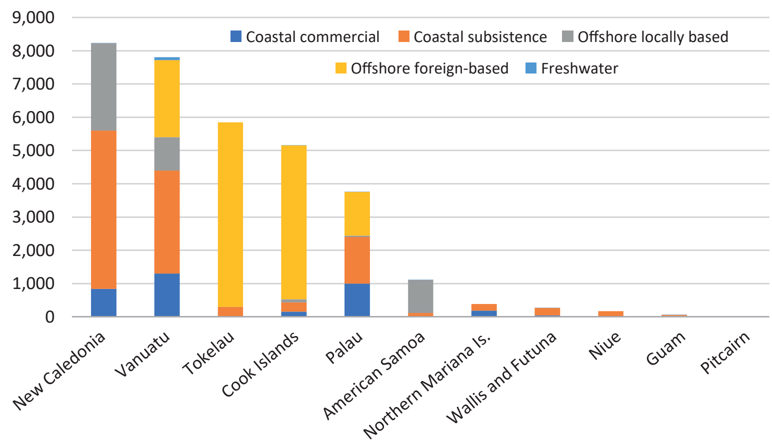



**Figure 29-2:** Volume of fishery production by category in the lower-producing countries/territories in 2021 (t)

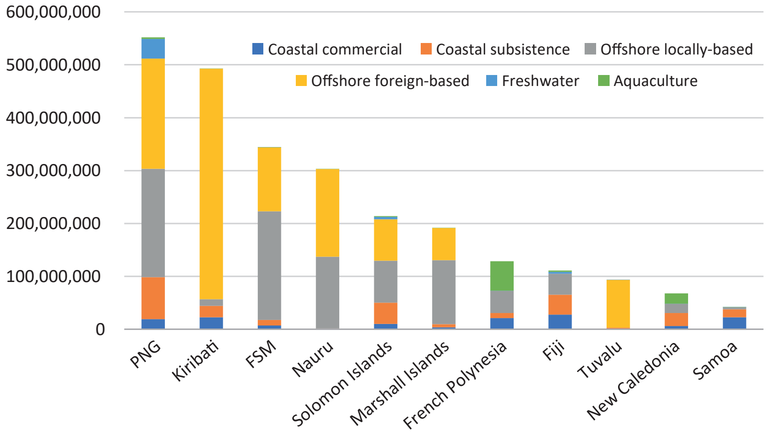



**Figure 29-3:** Value of fishery production by category in the higher-producing countries/territories in 2021 (US$)

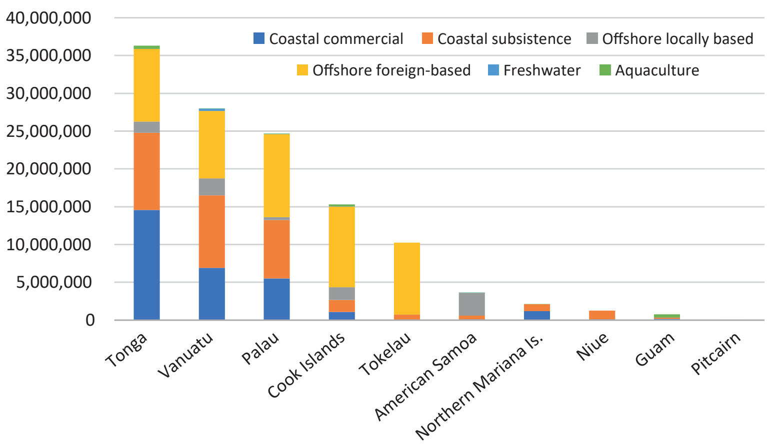



**Figure 29-4:** Value of fishery production by category in the lower-producing countries/territories in 2021 (US$)

In the two figures below, the volumes and values of production by fishery category are given. It can be seen that the two offshore fisheries (locally based and foreign-based) combined are responsible for most of the overall production: 87% by volume and 77% by value.

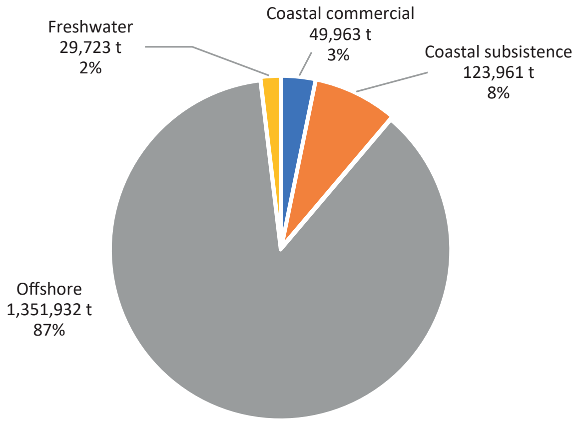



**Figure 29-5:** Share of regional fishery production volume by the different fishery categories (excluding aquaculture) in 2021 (t and %)

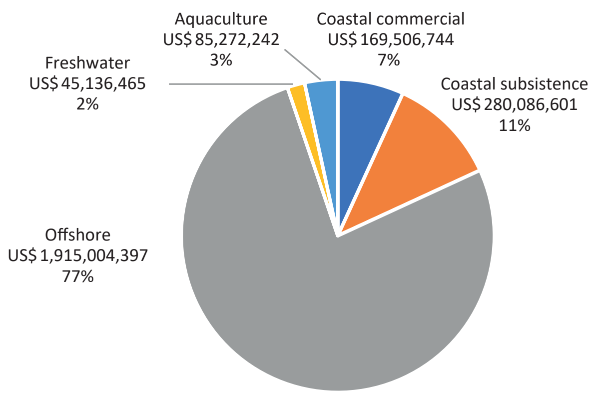



**Figure 29-6:** Share of regional fishery production value by the different fishery categories (including aquaculture) in 2021 (US$ and %)

In the two pie charts above, the offshore locally based and offshore foreign-based are combined. This is because of the required correction mentioned above (i.e. that offshore locally based catches in one country can be "offshore foreign-based" in a neighbouring country, so a correction required) – and it is not possible to distinguish the two in regional totals.

The following two figures deal with coastal fisheries production. PNG, Fiji and the Solomon Islands combined are responsible for 61% of all coastal fisheries production in the region. There is somewhat of a tendency for the more developed places to have proportionally less subsistence fishery production.

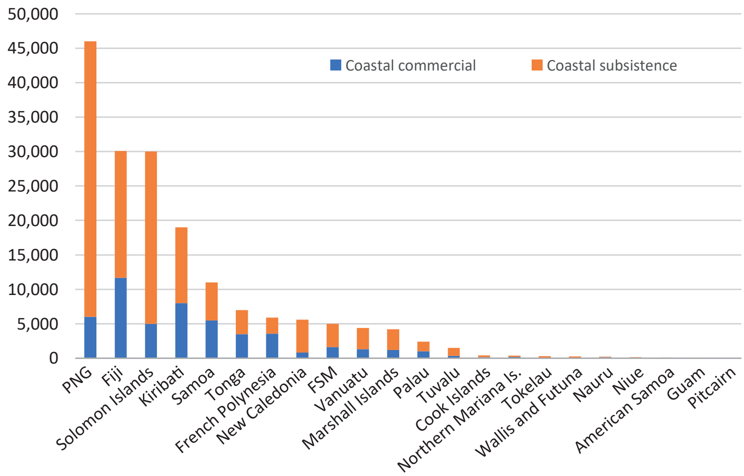



**Figure 29-7:** Coastal fishery production volume in 2021 for each country/territory (t)

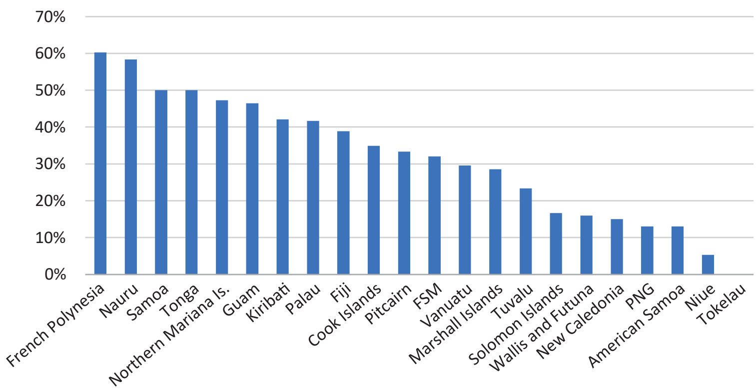



**Figure 29-8:** Coastal commercial fishery production volume in 2021 as a percentage of all coastal fishery production volume for each country/territory

The following three figures deal with offshore fisheries production. PNG and Kiribati combined are responsible for 39% of all offshore fisheries production in the region. As expected, the relatively underdeveloped atoll countries have proportionally the smallest amount of production from locally based vessels.[4]

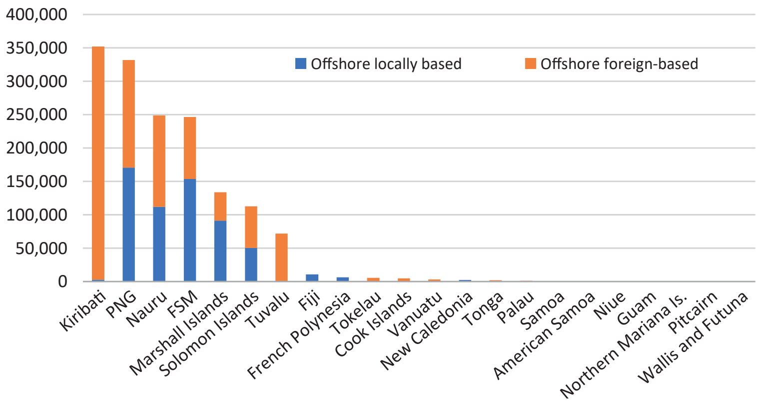



**Figure 29-9:** Offshore fisheries production in 2021 (t)

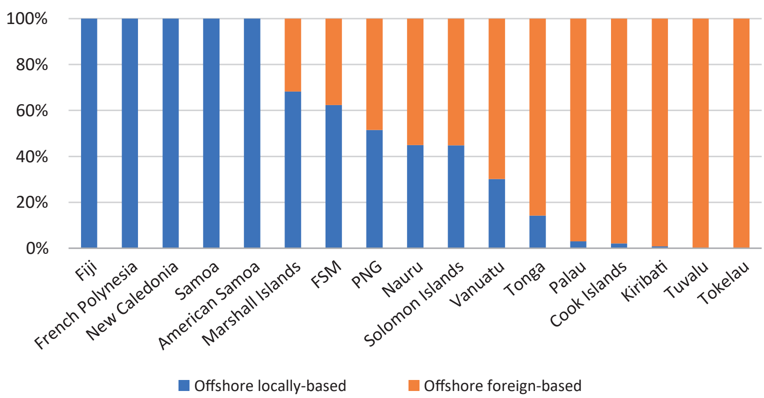



Figure 29-10: Locally based vs foreign-based offshore fishing in 2021

[4] The locally based offshore production of Nauru in the two graphs is based on the catches of the 19 purse seiners of the "national fleet" of Nauru as given in Nauru's report to the Scientific Committee of the WCPFC (NFMRA 2022).

Another way of looking at offshore fishing is the catch per square kilometre in each country's 200-mile zone. The combined 2021 production from locally and foreign-based offshore fishing was divided by the area of each 200-mile zone, with the results shown in Figure 29-11. The highest density of production is in countries which are Parties to the Nauru Agreement (PNA)[5], with the exception of Palau. Nauru has by far the highest density of production, almost eight times that of the second highest. This is due to a fairly small zone (320,000 km$^2$) and a substantial offshore catch (249,000 t).

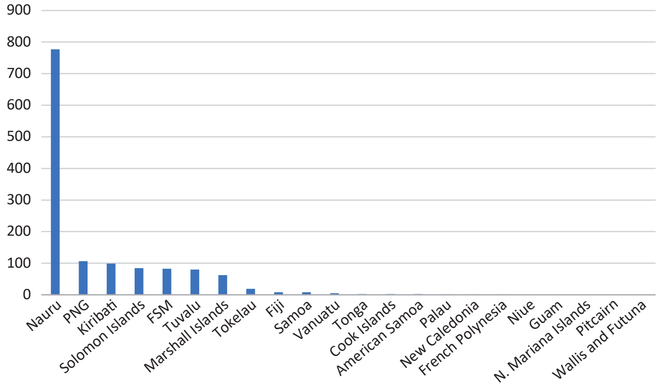



**Figure 29-11:** Offshore catch per square kilometre for countries and territories in 2021 (kg/km$^2$)

## 29.2 Some observations on fishery production in the region

The regional fishery production in 2021 is estimated to be 1,555,579 t, worth US$2,495,006,449.[6] In comparing these figures to other studies, it is important to note the definition of "region", and where on the value chain the value is estimated. The present study defines the region as the PICTs and their 200-mile zones, and the values reflect the prices paid to the producer or (for offshore fisheries) in-zone prices.

Table 29-5 gives the value per tonne by fishery category across the region. The unit value of coastal commercial fisheries (US$3,405/t) is greater than any of

[5] The Nauru Agreement (PNA) is a subregional agreement between the Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. The eight signatories collectively control 25–30% of the world's tuna supply and approximately 60% of the western and central Pacific tuna supply.

[6] This does not include the volume of aquaculture production due to the difference in units (i.e. both tonnes and pieces are used). In 2021 the volume of aquaculture production in the region was 7,573 t plus 8,825,931 pieces.

the other four fishery categories and 2.4 times the unit value of offshore foreign-based fisheries. The higher unit value of offshore locally based production relative to offshore foreign-based production reflects a higher proportion of locally based longlining. The lower value of freshwater production relative to coastal subsistence reflects the low imputed value of production in PNG's inland fisheries.

Table 29-5: Value per tonne by fishery category across the region in 2021

| | Coastal commercial | Coastal subsistence | Offshore locally based | Offshore foreign-based | Freshwater |
|---|---|---|---|---|---|
| Total value (US$) | 169,506,744 | 280,086,601 | 870,956,721 | 1,210,569,797 | 45,136,465 |
| Total volume (t) | 49,963 | 123,961 | 603,888 | 932,398 | 29,723 |
| Unit value (US$/t) | 3,393 | 2,259 | 1,442 | 1,298 | 1,519 |

The unit values in the table above (for 2021) are generally lower than that of the previous Benefish study (for 2014). This is due to several factors, including a declining price for purse seine skipjack/yellowfin over the period (FFA 2022b), Covid, and because sea cucumber (a very high-priced commodity) was not harvested in 2021 in most countries/territories of the region. Also to be considered is that in the most recent Benefish study, more attention was focused on coastal fishery prices than in the past.

Earlier studies by FFA and the Asian Development Bank (Gillett et al. 2001) compared the production from offshore fisheries to that from coastal fisheries. In the present study, the total production by volume from offshore fisheries of the region is almost nine times that of coastal fisheries. By value, it is only about 4.4 times greater due to the high unit value of coastal fishery production and very high value of some coastal commodities (e.g. sea cucumber).

Some other notable features of the overall fishery production of the region are:

- The total production from the region in 2021 (1,555,579 t) divided by the population of the region in 2021 (12,530,000 people) equates to 124 kg of fish per person.
- Considering that coastal fisheries provide the vast majority of fish from the region for consumption by PICT residents (i.e. almost all the production from offshore fisheries in the region is shipped out of the region[7]), the annual per capita supply of coastal fish is crucially important. In 2021 this supply was 13.8 kg per capita.

[7] Tolvanen et al. (2019) found that in 2016 only 0.8 % of the total catch of locally based fleets in the region was entering local markets, with 99.2% being exported to foreign markets.

- From Figures 29-1 and 29-2 (Volume of fishery production by category), it is evident that whether a PICT is among the "top producing countries" is strongly determined by its offshore fisheries production.
- Comparing the pie charts on value, the share for coastal commercial fishing is larger due to its high unit value, and the share for offshore foreign-based fishing is lower due to the low unit value for skipjack.
- Aquaculture production is only relatively important (i.e. visible in the above graphs of fishery production by category) in two places, French Polynesia and New Caledonia.
- Freshwater fisheries are only relatively important in one country of the region, PNG.

Notable features of coastal fisheries are as follows:

- The volume for all coastal fisheries (commercial and subsistence) in PNG is about one quarter of the regional total.
- The production from Fiji's coastal commercial fisheries is greater than from any other PICT, even PNG, which has a population almost nine times greater. Even considering coastal populations (i.e. those that reside within 20 km of the coast; 2,723,214 in PNG, 819,343 in Fiji), Fiji's coastal commercial production is almost twice as much, despite having less than a third of the coastal population. This is likely to be due to the undeveloped nature of PNG's coastal commercial fisheries.
- The degree of commercialisation of the coastal fisheries of Tonga and Samoa (i.e. the ratio of commercial to subsistence) appears to be surprisingly high. A major factor could be the high per capita level of overseas remittances, facilitating the purchase of fish.
- The degree of commercialisation of the coastal fisheries of New Caledonia and American Samoa appears to be surprisingly low. This is likely to be due to numerous employment alternatives to fishing in those two territories.

Notable features of offshore fisheries are as follows:

- The volume of the production from offshore fishing in the Kiribati zone in 2021 (352,031 t) is greater than any other PICT in the region – despite 2021 not being an El Niño year.
- From Figure 29-9 (Offshore fisheries production in 2021), it is evident that the vast majority of offshore fisheries production comes from countries that are members of PNA and from areas within 10 degrees latitude of the equator.
- Two countries in an area of relatively good tuna fishing had almost no locally based offshore fishery production in 2021: Kiribati and Tuvalu.

- From Figure 29-10 (Locally based vs foreign-based offshore fishing), it can be seen that in about one third of the countries significantly involved in offshore fisheries, the fleet is all locally based; in one third it is a mixture of locally and foreign based; and in one third it is all foreign based.
- Almost half of the PICTs in the region have no offshore foreign-based fishing. The main reasons for this are because of the policies of the metropolitan country to which the territory is affiliated (4 territories), a desire to protect domestic fleets (2 countries, 2 territories), the zone being a large marine protected area (1 territory) and being located away from prime fishing areas (1 country).
- Although Palau is a PNA country, the production from its offshore fishing is lower than that from six non-PNA countries. This is due to the winding down of offshore fishing in preparation for implementation of the Palau National Marine Sanctuary.

## 29.3 Aquaculture production in the region

In 2021 aquaculture production in the region was estimated at 7,573 t and 8,825,931 pieces, worth US$85,272,242 (3.4% of the value of all fisheries and aquaculture in the region).

The estimate of the value of aquaculture in the region from the present study is reasonably close to an estimate made by the Food and Agriculture Organization (FAO) of the United Nations. FAO carried out a desktop review of peer-reviewed and grey literature and had interviews with staff of various organisations that focus on aquaculture development in the Pacific region. The report of the study (Mori et al. 2022) stated that total aquaculture production across the PICTs in 2020 had an estimated value of US$92.5 million.

The value of production estimated by the present study by country/territory is shown in Figure 29-12.

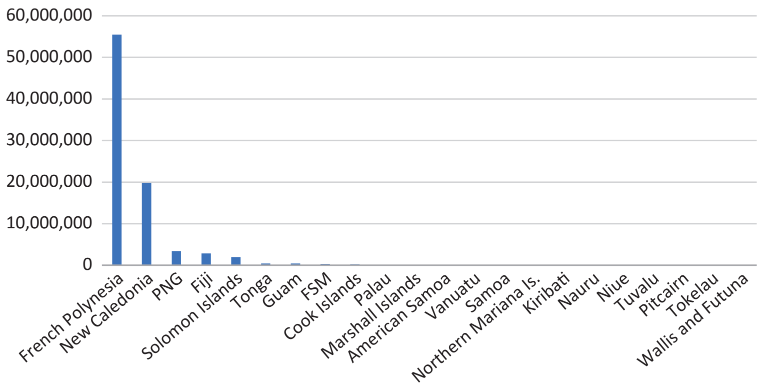



**Figure 29-12:** Value of aquaculture production by countries and territories in 2021 (US$)

The figure shows an important reality: two French territories were responsible for 88.3% of the value of all aquaculture production in the region in 2021.

The leading aquaculture activities in 2021 (i.e. those that had a production with a farm gate value above US$ 1 million) are given in Table 29-6.

**Table 29-6:** Leading aquaculture activities in 2021

| Activity | Value of production (US$ millions) |
|---|---|
| Pearls in French Polynesia | 50.2 |
| Shrimp in New Caledonia | 18.5 |
| Shrimp in French Polynesia | 3.2 |
| Tilapia in PNG | 2.4 |
| Seaweed in Solomon Islands | 1.9 |
| Pearls in Fiji | 1.4 |
| Tilapia in Fiji | 1.0 |

In examining aquaculture production in Pacific Island countries, some insight can be obtained by eliminating from consideration those countries or territories that have atypical aquaculture conditions in the region. Atypical territories include French Polynesia and New Caledonia, with their high degree of support from France and large subsidies targeting aquaculture. PNG is also eliminated here due to its relatively large population (over twice as many people as all the other 21 countries of the region combined), many of whom live inland

and have no direct access to marine resources. Clearly, these three PICTs have aquaculture conditions that are very different to the rest of the region. Figure 29-13 shows the value of aquaculture production in the region excluding French Polynesia, New Caledonia and PNG.

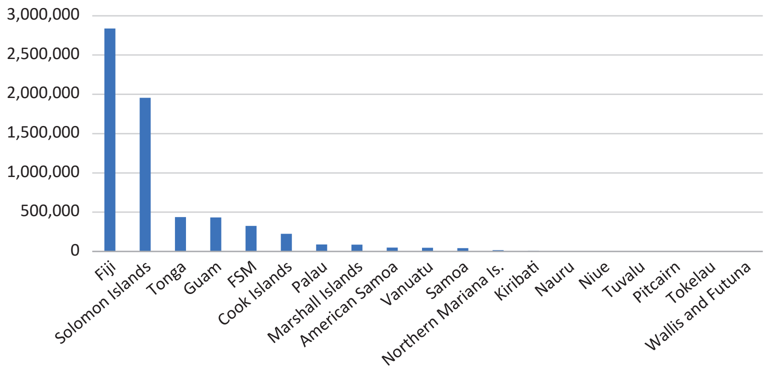



**Figure 29-13:** Value of aquaculture production in 2021 excluding three atypical countries/territories (US$)

If aquaculture production from the atypical French territories and PNG is eliminated, significant aquaculture production comes from a limited range of activities:

- Large-scale private-sector pearl culture and shrimp culture where there is a significant tourist trade or affluent local residents.
- Giant clams, mostly private sector and mostly in Micronesia.
- Seaweed, formerly in many low-wage countries but in 2021 only significant in the Solomon Islands.
- Significant amounts of tilapia in Fiji, Solomon Islands, Vanuatu and Guam, with much smaller amounts in many other countries.
- Small amounts of other commodities (e.g. milkfish, coral) in several countries.

From Figure 29-13 above, combined with the table on regional fishery/aquaculture production in a previous section and the country and territory chapters, a number of features are notable:

- Aquaculture production is significant (i.e. annual production worth more than US$50,000) in only 11 of the 22 PICTs. If the definition of "significant" is raised to US$100,000 (as suggested by one reviewer of this document), then aquaculture is significant in only nine PICTs.
- Five PICTs have aquaculture production worth more than US$500,000, with three of those being the aforementioned atypical ones.

- Giant clam culture is important in the region, but several producers have the perception that overproduction from subsidised operations in French Polynesia is placing a major constraint on the trade.

Many of the apparently successful aquaculture activities in the region involve taking advantage of relatively affluent tourists or elite local residents (when present). This applies to shrimp culture (in New Caledonia and Fiji) and pearl culture (in Fiji, Tonga and the Cook Islands). As an example of this, the relatively low-value mabe pearls grown in Tonga are mostly sold directly to tourists and had an average farm gate value in 2021 of US$13 per pearl (Tonga chapter in this report). The average price in 2021 for the relatively high-quality round pearls from French Polynesia was US$4.60 per pearl (DRM 2022a).

Due to the different sizes of the countries/territories and associated fisheries, the above graph may distort the situation in the smaller countries or territories. It is important to put aquaculture production in the context of other forms of fishery production in each country or territory. While aquaculture could be compared to all fishery production, the very large tuna fisheries in some countries would distort the comparison. To avoid this distortion, Figure 29-14 compares aquaculture production to coastal fishery production (commercial and subsistence) in the countries and territories.

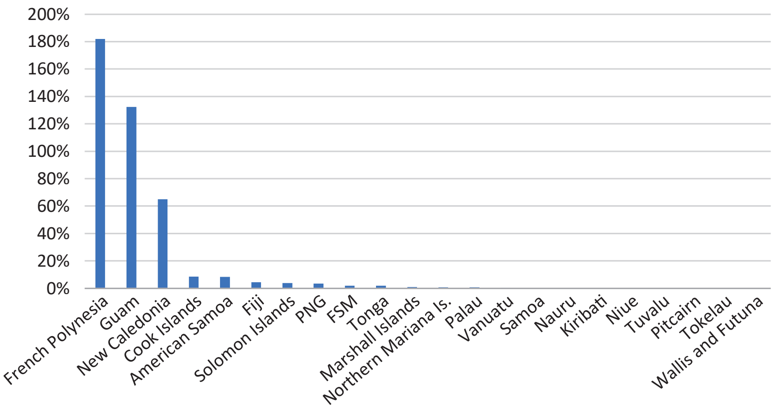



**Figure 29-14:** Aquaculture production as a percentage of coastal fishery production

In only four territories and one country was the value of aquaculture production in 2021 greater than 5% of the coastal fishery production value.

One of the most remarkable points about aquaculture in the region – and perhaps one of the most remarkable observations during the present study – is the lack of knowledge of the overall aquaculture production in almost every PICT.

In the course of this Benefish study, despite internet searches, discussions with national and regional aquaculture authorities, consultations with private sector aquaculturalists, and interaction with an author of a recent regional review of PICT aquaculture, not a single document was identified that gave national aquaculture production. Furthermore, in only two PICTs (PNG and French Polynesia) was it possible for the authors of the present study to find an individual who could summarise national aquaculture production. Considering the enormous amount of development funds and public money spent on the promotion of aquaculture in the region (often at the expense of improving coastal fisheries management), it is amazing that there is so little monitoring of the progress of aquaculture development in terms of the total volume and value of production. One wonders how progress in aquaculture is determined, or how the effectiveness of past development efforts is gauged, or if more spending on aquaculture promotion in the future is justified. The other aspect of this issue is that compared to the difficulty of monitoring small-scale fisheries, tracking aquaculture production is not very difficult: the ponds do not move around, several types of remote sensing are applicable, and ongoing subsidies for many aquaculture operations provide an entry point for monitoring.

Another point that should be made is that aquaculture is often promoted on the basis of food security and/or livelihood security during disasters. Although difficult to quantify, an impression was gained during the present study that despite aquaculture being promoted for disaster mitigation, there are many cases of aquaculture being severely affected by disasters – and more so than other categories of fishing ("first to fold in a crisis"). This is likely because many types of aquaculture require external inputs (e.g. fry, feed, electricity). Examples of this are:

- After a typhoon in 2015, the shrimp farms in Saipan were damaged, and all production stopped (CNMI chapter of this report).
- There was no culturing of *Macrobrachium* in Vanuatu in 2021 due to the loss of broodstock in 2020 as a result of an electric power outage (Vanuatu chapter of this report).
- The destruction caused by Cyclone Pam in March 2015 was a major factor in the closing of two companies in Vanuatu that were culturing aquarium products (Gillett et al. 2020).
- During Covid, supplies of seed and feed to many aquaculture operations were impacted (IAS 2022).
- Pearl farming and the culture of moi in the Marshall Islands stopped during Covid (IAS 2022).

- Much of the reduction in the number of pearl farms in Manihiki was due to Cyclone Martin (Cook Islands chapter of this report).
- Seaweed culture in Tonga suffered from the volcanic eruption (IAS 2022).

## 29.4 Changes in fishery production between 2014 and 2021

In previous studies of fisheries-related benefits to PICTs (the "Benefish" studies), Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009a) on 2007, Gillett (2016) on 2014, and the present study on 2021. The 2001 study did not include the eight non-independent territories, nor did it cover freshwater fisheries and aquaculture. The 2007, 2014 and 2021 studies are therefore more directly comparable.

Two important points should be made before comparing the results of the Benefish studies. First, the apparent changes in production between the three studies represents a real change in production in some cases, but this can also represent a change in the methodology used for measuring the production (hopefully, an improvement) or the availability of new information. In the comparison tables and figures below, the production of coastal commercial, coastal subsistence and freshwater fisheries often changes significantly between the years, but in some cases the change is at least partly due to the way in which the production was estimated. In contrast, changes in production for offshore fisheries are likely to reflect real changes in the amounts being harvested (because of the availability of better-quality data).

The second point is that while comparing volumes of fishery production between the Benefish studies is straightforward, comparing values is more difficult because of the need to express, for example, 2007 values in 2014 prices. Complications that arise from converting values include the following:

- The present study involves 22 countries and territories and 10 different currencies.
- While the use of a fish consumer price index (CPI) could be used for the conversion, the national fish CPIs are not readily available for most countries/territories in the region.
- Where fish CPIs are available, there is concern that: (a) they are not likely to realistically reflect actual changes in a properly balanced basket of multiple fish species, qualities and sizes; (b) they are not applicable to some of the fishery products in this study (e.g. pearls); and (c) they are not appropriate for changes in values of the production of foreign-based offshore fishing – which mostly never touches land anywhere in the region.

A final point is that changes in aquaculture production can be compared in value, but it is much more difficult to compare changes in volumes because of the mix of units of production.

## 29.5 Changes in volumes of fishery production

In the 22 countries and territories, the total volume of fishery production in the period between 2007 and 2021 increased by 295,746 t, or 20.4%. The changes in volume of the fishery production in each PICT are given in the country and territory chapters. Table 29-7 compiles the results.

Table 29-7: Volume of fishery production by PICT, 2007 vs 2014 vs 2021 (t)

| | Year | Coastal commercial | Coastal subsistence | Offshore local | Offshore foreign | Freshwater | Total |
|---|---|---|---|---|---|---|---|
| Kiribati | 2007 | 7,000 | 13,700 | 0 | 163,215 | 0 | 183,915 |
| | 2014 | 7,600 | 11,400 | 510 | 701,067 | 0 | 720,577 |
| | 2021 | 8,000 | 11,000 | 2,686 | 349,345 | 0 | 371,031 |
| PNG | 2007 | 5,700 | 30,000 | 256,397 | 327,471 | 17,500 | 637,068 |
| | 2014 | 6,500 | 35,000 | 216,896 | 217,871 | 20,000 | 496,267 |
| | 2021 | 6,000 | 40,000 | 170,755 | 161,133 | 23,000 | 400,888 |
| Nauru | 2007 | 200 | 450 | 0 | 69,236 | 0 | 69,886 |
| | 2014 | 163 | 210 | 0 | 177,315 | 0 | 177,688 |
| | 2021 | 140 | 100 | 111,821 | 136,893 | 0 | 248,954 |
| FSM | 2007 | 2,800 | 9,800 | 16,222 | 143,315 | 1 | 172,138 |
| | 2014 | 1,725 | 3,555 | 40,838 | 124,481 | 1 | 170,600 |
| | 2021 | 1,600 | 3,400 | 153,578 | 92,899 | 1 | 251,478 |
| Solomon Islands | 2007 | 3,250 | 15,000 | 23,619 | 98,023 | 2,000 | 141,892 |
| | 2014 | 6,468 | 20,000 | 41,523 | 36,573 | 2,300 | 106,864 |
| | 2021 | 5,000 | 25,000 | 50,597 | 62,234 | 2,500 | 145,331 |
| Marshall Islands | 2007 | 950 | 2,800 | 63,569 | 12,727 | 0 | 80,046 |
| | 2014 | 1,500 | 3,000 | 85,918 | 29,754 | 0 | 120,172 |
| | 2021 | 1,200 | 3,000 | 91,167 | 42,514 | 0 | 137,881 |
| Tuvalu | 2007 | 226 | 989 | 0 | 35,541 | 0 | 36,756 |
| | 2014 | 300 | 1,135 | 0 | 96,898 | 2 | 98,335 |
| | 2021 | 350 | 1,150 | 0 | 71,817 | 2 | 73,319 |
| Fiji | 2007 | 9,500 | 17,400 | 13,744 | 492 | 4,146 | 45,282 |
| | 2014 | 11,000 | 16,000 | 17,079 | 0 | 3,731 | 47,810 |
| | 2021 | 11,700 | 18,400 | 10,828 | 0 | 4,000 | 44,928 |
| Tokelau | 2007 | 0 | 375 | 0 | 318 | 0 | 693 |
| | 2014 | 40 | 360 | 0 | 24,286 | 0 | 24,686 |
| | 2021 | 0 | 300 | 0 | 5,548 | 0 | 5,848 |
| Cook Islands | 2007 | 133 | 267 | 3,939 | 0 | 5 | 4,344 |
| | 2014 | 150 | 276 | 194 | 20,342 | 5 | 20,967 |
| | 2021 | 150 | 280 | 100 | 4,621 | 5 | 5,156 |
| Vanuatu | 2007 | 538 | 2,830 | 0 | 12,858 | 80 | 16,306 |
| | 2014 | 1,106 | 2,800 | 568 | 10,942 | 80 | 15,496 |
| | 2021 | 1,300 | 3,100 | 1,000 | 2,320 | 88 | 7,808 |

| | Year | Coastal commercial | Coastal subsistence | Offshore local | Offshore foreign | Freshwater | Total |
|---|---|---|---|---|---|---|---|
| French Polynesia | 2007 | 4,002 | 2,880 | 6,308 | 0 | 100 | 13,290 |
| | 2014 | 5,666 | 2,350 | 5,390 | 0 | 100 | 13,506 |
| | 2021 | 3,565 | 2,350 | 6,405 | 0 | 100 | 12,420 |
| Samoa | 2007 | 4,129 | 4,495 | 3,755 | 25 | 10 | 12,414 |
| | 2014 | 5,000 | 5,000 | 1,254 | 0 | 10 | 11,264 |
| | 2021 | 5,500 | 5,500 | 1,001 | 0 | 10 | 12,011 |
| Tonga | 2007 | 3,700 | 2,800 | 1,119 | 0 | 1 | 7,620 |
| | 2014 | 3,900 | 3,000 | 1,363 | 1,891 | 1 | 10,155 |
| | 2021 | 3,500 | 3,500 | 290 | 1,759 | 1 | 9,050 |
| Palau | 2007 | 865 | 1,250 | 3,030 | 1,464 | 1 | 6,610 |
| | 2014 | 865 | 1,250 | 3,987 | 4,017 | 1 | 10,120 |
| | 2021 | 1,000 | 1,400 | 41 | 1,315 | 1 | 3,757 |
| New Caledonia | 2007 | 1,350 | 3,500 | 2,122 | 0 | 10 | 6,982 |
| | 2014 | 1,350 | 3,500 | 2,876 | 0 | 10 | 7,736 |
| | 2021 | 680 | 4,760 | 2,625 | 0 | 10 | 8,075 |
| American Samoa | 2007 | 35 | 120 | 6,632 | 0 | 1 | 6,788 |
| | 2014 | 42 | 120 | 2,154 | 0 | 1 | 2,317 |
| | 2021 | 15 | 100 | 994 | 0 | 1 | 1,110 |
| Wallis and Futuna | 2007 | 121 | 840 | 0 | 0 | 0 | 961 |
| | 2014 | 150 | 675 | 0 | 0 | 0 | 825 |
| | 2021 | 42 | 221 | 0 | 0 | 1 | 264 |
| Niue | 2007 | 10 | 140 | 640 | 0 | 0 | 790 |
| | 2014 | 11 | 154 | 0 | 547 | 0 | 712 |
| | 2021 | 9 | 160 | 0 | 0 | 0 | 169 |
| Northern Mariana Is. | 2007 | 142 | 350 | 0 | 0 | 0 | 492 |
| | 2014 | 231 | 220 | 0 | 0 | 0 | 451 |
| | 2021 | 183 | 204 | 0 | 0 | 0 | 387 |
| Guam | 2007 | 44 | 70 | 0 | 0 | 3 | 117 |
| | 2014 | 72 | 42 | 0 | 0 | 3 | 117 |
| | 2021 | 26 | 30 | 0 | 0 | 3 | 59 |
| Pitcairn | 2007 | 5 | 7 | 0 | 0 | 0 | 12 |
| | 2014 | 3 | 6 | 0 | 0 | 0 | 9 |
| | 2021 | 3 | 6 | 0 | 0 | 0 | 9 |

The information in Table 29-7 is displayed graphically in the figures below, with the countries and territories separated into three groups (higher producing, middle producing and lower producing) so that the volumes of the lower-producing countries/territories are discernible.

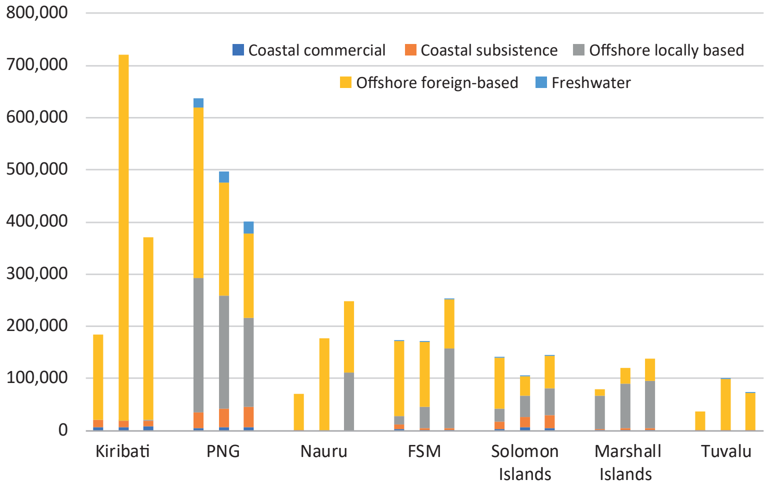



**Figure 29-15:** Change in volume of production of the higher-producing countries/territories, 2007 vs 2014 vs 2021 (t) Note: the three bars for each country represent 2007, 2014 and 2021

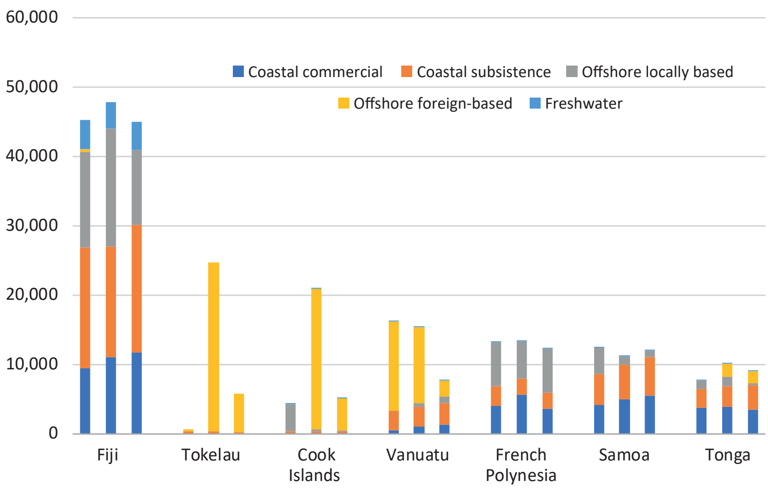



**Figure 29-16:** Change in volume of production of the medium-producing countries/territories, 2007 vs 2014 vs 2021 (t)

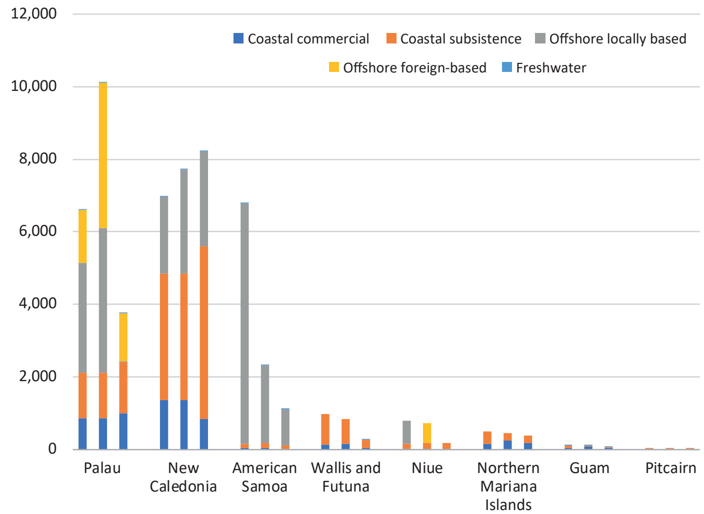



**Figure 29-17:** Change in volume of production of the lower-producing countries/territories, 2007 vs 2014 vs 2021 (t)

In considering the changes over the 14 years spanned by the three Benefish studies, two points related to fisheries production should be noted:

- 2007 was a weak La Niña year, 2014 was a weak El Niño year, and 2021 was a moderate La Niña (https://ggweather.com/enso/oni.htm). This would impact the offshore fisheries in that in 2014 areas favourable to purse seining would have moved east towards Kiribati, while in 2007 and 2021 those areas would have moved to the west towards PNG and FSM.
- 2021 was in the Covid period. Although Covid affected the various PICTs in different ways, in general many PICTs experienced depressed coastal commercial production and moderately elevated coastal subsistence production. The impact of Covid on offshore fisheries operations was greatest in 2020 and by 2021, many (but not all) of those impacts were mitigated.

In the figure for the higher-producing countries/territories, it is clear that change in offshore catches (especially offshore foreign-based catches) caused most of the change over the period. For the lower-producing countries/territories, changes in both coastal commercial catches and offshore catches (mostly locally based) are the main causes. In general, the production of coastal fisheries (especially coastal subsistence) tends to vary less over the years than that of the offshore fisheries. The changes in offshore production of most of the lower-producing countries/territories are largely due to variable catch rates of southern albacore, or in one case (Tonga) a change in the management of the fishery to allow foreign-based fishing.

The three periods can be compared with respect to the regional totals in each fishery category (Table 29-8 and Figure 29-18).

**Table 29-8:** Regional totals in each fishery category, 2007 vs 2014 vs 2021 (t)

| | Coastal Commercial | Coastal Subsistence | Offshore locally based | Offshore foreign-based | Freshwater | Total |
|---|---|---|---|---|---|---|
| 2007 | 44,789 | 109,933 | 401,096 | 864,685 | 23,858 | **1,446,361** |
| 2014 | 53,753 | 110,183 | 420,550 | 1,445,984 | 26,245 | **2,056,715** |
| 2021 | 49,963 | 123,961 | 603,888 | 932,398 | 29,723 | **1,739,933** |

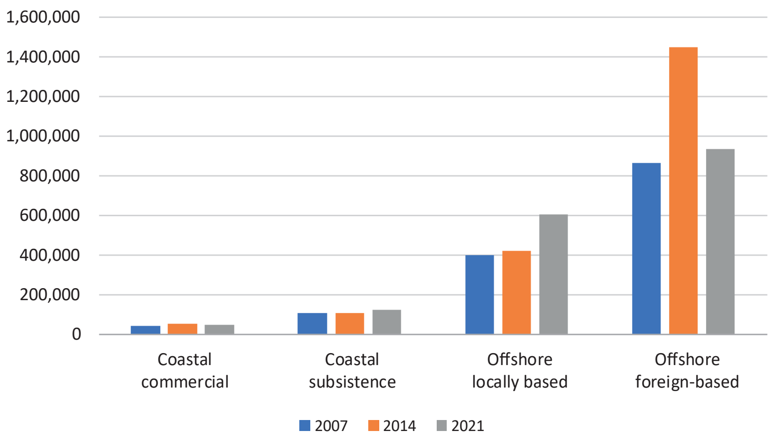



**Figure 29-18:** Regional totals in each fishery category, 2007 vs 2014 vs 2021 (t)

The above table and graph are consistent with a point mentioned above: during the Covid year of 2021 there was depressed coastal commercial production and elevated coastal subsistence production. To some extent, the El Niño / La Niña impacts on regional offshore production would be masked (i.e. when it goes up in the east, it goes down in the west). The pronounced spike in foreign-based offshore production in 2014 could be due to 2014 being an El Niño year and consequently, the areas favourable to purse seining would have moved towards the east where there were much fewer locally based purse seiners.

Table 29-9 below shows the total coastal fisheries production of the region (from previous studies) divided by the population of the region.

Table 29-9: Per capita coastal fishery production, 2007 vs 2014 vs 2021

| | Coastal commercial production (t) | Coastal subsistence production (t) | Total coastal production (t) | Total population | Per capita coastal fisheries production (kg/person/year) |
|---|---|---|---|---|---|
| 2007 | 44,789 | 109,933 | 154,722 | 9,591,000 | 16.1 |
| 2014 | 53,753 | 110,183 | 163,936 | 11,020,000 | 14.9 |
| 2021 | 49,963 | 123,961 | 173,924 | 12,550,000 | 13.9 |

Source: Gillett (2009a), Gillett (2016) and the present study; population from SPC/SDD

As most of the domestically derived fish for consumption in PICTs comes from coastal fisheries, changes in per capita coastal fisheries production are critically important. A notable decline in consumption rate may be one of the most significant findings of the present study as a decrease of 14% over 21 years is cause for major concern.[8] This issue will be re-visited in the Fish Consumption chapter below.

## 29.6 Changes in values of fishery production

There is no simple and accurate way to compare values of fishery products across the countries of the region over time. However, for illustrative purposes, the present study inflates 2007 and 2014 values by the composite CPI for the United States, Australia and New Zealand to arrive at values in 2021 prices to give an idea of real value changes. This is a crude way to convert values and is more applicable to overall regional changes than those in individual countries. Should more appropriate ways to convert values of fishery and aquaculture production become available at the national level, considerable insight might be gained, and national fisheries specialists and economists are encouraged to pursue the issue.

The changes in the value of fishery production between 2007 and 2021 in each of the PICTs are provided in the country and territory chapters. Table 29-10 shows the regional changes. It compares the real value of production for the six fishery categories in 2007[9], 2014 and 2021.

[8] While it could be argued that the non-coastal population of some of the larger countries in Melanesia could distort this finding, the populations were treated consistently in the 2007, 2016 and present study – so the trend is valid.

[9] During the present study, an error was found in the value of the 2007 coastal commercial production, which has been corrected in this table.

**Table 29-10**: Values of production from the different fishery categories, 2007 vs 2021 (US$)

| Year of study | Coastal commercial | Coastal subsistence | Offshore locally based | Offshore foreign-based | Freshwater | Aquaculture |
|---|---|---|---|---|---|---|
| 2007 (converted to 2021 US$ values) | 217,678,210 | 263,234,098 | 784,100,037 | 1,427,507,426 | 30,367,595 | 192,955,114 |
| 2014 (converted to 2021 US$ values) | 243,660,527 | 264,082,674 | 827,116,428 | 2,546,101,758 | 52,117,509 | 129,926,187 |
| 2021 (US$) | 169,506,744 | 280,086,601 | 870,956,721 | 1,210,569,797 | 45,136,465 | 85,272,242 |
| Real % Change 2007–2021 | -22.1% | +6.4% | +11.1% | -15.2% | +48.6% | -55.8% |

The following observations can be made on the above table:

- Expressed in 2021 prices, in the 22 countries and territories the combined real value of all six categories of fishery and aquaculture production was about the same in 2021 as it was in 2007.
- As mentioned earlier, coastal commercial production suffered a considerable decline during the Covid period – and this is likely to be responsible for much of negative growth shown in the table.
- The negative growth of production from offshore foreign-based fishing is probably due to two factors: (1) the decline in real price for skipjack between 2007 and 2021 (FFA 2022b), and (2) the transfer of some vessels from offshore foreign-based to offshore locally based.
- Areas of concentration of fish targeted by purse seiners tend to move around. Under the purse seine vessel day scheme, the countries where the fish have moved to need to purchase days, and thus benefits are somewhat more levelled than the statistics may suggest.
- The increase in the value of freshwater production between 2007 and 2014 was due to a more realistic price being used by the 2014 Benefish study for freshwater catches in PNG, which has by far the largest freshwater fishery in the Pacific Islands.
- The decline in aquaculture between 2014 and 2021 could possibly be explained by (1) the fact that many operations folded during recent disasters, as mentioned above, and (2) the fall in pearl production in the Cook Islands and French Polynesia.

## 29.7 Measuring fishery production in the region

### General issues

The situation for measuring fishery production in the region for offshore fisheries is very different to that for coastal fisheries. Overall, the offshore statistical systems are in relatively good condition at both national and regional levels – SPC's Oceanic Fisheries Programme having played a major role in upgrading national capacity in this area. However, coastal fishery statistical systems are not nearly as good. Typically, government fishery agencies give low priority to collecting data on coastal catches, which are also far more challenging to estimate. In general, the smaller the scale of the fishing, the less is known about the production levels, with quantitative information being especially scarce for subsistence fisheries in most countries.

The country and territory chapters of this book contain comments on the accuracy of national production data. Following the table summarising national fisheries production in many of the country and territory chapters is a statement indicating the lack of good information for making estimates of coastal fisheries production, such as: "The extremely weak factual basis for the estimates of coastal commercial and coastal subsistence catches is recognised."

In some respects, this situation is a tragedy. The importance of food security and the role played by coastal fisheries are beyond dispute, but in order to effectively safeguard the flow of food from coastal fisheries, it is essential that the flow is quantified. The axiom that "you can manage what you can measure" (as well as its converse) certainly applies. Understanding the impact of fishing and other influences on coastal fish populations is a key role of government departments, which under their various fisheries legislation, typically have the responsibility to ensure that the sustainability of coastal fisheries is not compromised.

Several countries – Fiji, Samoa, Palau and Tokelau – have carried out intensive, well-planned surveys of coastal fisheries in recent decades to obtain an accurate "snapshot" which can be expanded to give estimates of annual production. These surveys seemed to produce reasonably good assessments of coastal fishery production; however, only two snapshot fishery surveys seem to have been carried out in the past 15 years – in the Marshall Islands in 2010 and in Samoa in 2012.

Recently, efforts are being made to improve the situation of coastal fisheries statistics. SPC and other agencies are making commendable efforts to help PICTs monitor their coastal fisheries. An example of this is Tuvalu (Box 29-1).

**Box 29-1: Creel surveys to improve monitoring of small-scale fisheries in Tuvalu**

An inshore Fisheries Adviser (funded by the New Zealand Aid Programme) worked in Tuvalu during the period 2015-2020. One of the activities of the adviser was to help establish and facilitate creel surveys.

Creel surveys are the primary method of collecting coastal fisheries data in Tuvalu. Creel data provide important insights on harvests, effort, and fisher perceptions, which ultimately inform management decisions. The surveys are low-cost, easy to implement and provide a rapid assessment of coastal fisheries resources. Tuvalu now has one of the longest-running creel data collection programmes in the Pacific; more than 80,000 fish have been measured in the 3,500+ surveys carried out across the 9 islands since 2015. Data collectors play an important role in continuing this programme, by collecting and monitoring fishers' catch at the landing sites.

The Coastal Fisheries Creel Report Card summarises the results of monitoring key indicators during creel surveys. The key indicators used to show the health of the resources are: (1) Percentage of fishes that are landed which are smaller than the size at which at least 50% of the fish can breed and (2) Catch of fishes per unit of effort.

Source: Coastal Fisheries Creel Report Card (TFD 2020); Fisheries Department Annual Report 2021 (TFD 2022b)

According to the former Tuvalu Inshore Fisheries Adviser, the creel surveys have not yet been used to estimate fisheries production (U. Kaly, per. com. September 2022). This situation (i.e. lack of expansion of the survey results to approximate total catches) is similar to that of the relatively new programmes of coastal fisheries monitoring in several other Pacific Island countries. Some of the older coastal fisheries statistical systems in PICTs suffer from a similar problem: having a good sampling programme but no methodology (or more accurately, a forgotten methodology) for converting the quantity sampled to a provincial or national total. In several cases, the sampled quantities are reported by fishery departments in such a way that they appear to be a national total.

Another aspect of the above issue is the current emphasis on coastal fishery sampling programmes achieving biological objectives, such as the assessing of the condition of fish populations. Considering the difficulty in obtaining funding for coastal fisheries monitoring in most Pacific Island countries and the usefulness of knowing total national coastal catches and their change over time, there is a strong case for including estimation of total coastal fishery catches when designing and promoting new monitoring programmes.

In terms of other improvements in measuring coastal fisheries production, the household income and expenditure survey (HIES) has considerable potential for improving catch estimates (next section).

## Household income and expenditure surveys

The use of a HIES for fishery purposes has been covered by previous Benefish surveys. To summarise:

- All of the PICTs have had, and will continue to carry out in the future, a HIES. Although it is a major tool of statistical departments in the region for estimating the contribution of coastal fisheries to GDP, most fisheries departments are apathetic to the concept of using a HIES to estimate coastal fisheries production.
- The HIES can give information on coastal fishery production at little or no cost to fishery departments, but in the past there have been doubts as to the accuracy of annual coastal fishery production estimates made from the results of a HIES.
- The SPC Statistics for Development Division (SDD) has put a considerable amount of effort into improving the use of the HIES for fishery purposes, and the current HIES methodology promoted by SPC is thought to be reasonably effective for various types of fishery estimations, including national coastal commercial production, national coastal subsistence production and per capita fish consumption.
- The statistics departments of most Pacific Island countries use the HIES to estimate the value of small-scale fisheries for GDP purposes – but the staff of fisheries departments are typically not fully aware of the HIES methodology and advantages/disadvantages of using a HIES for fishery purposes.
- The fisheries departments of the region should be encouraged to make more use of the HIES in their coastal fisheries work. As an initial step, fisheries departments should proactively become more involved in the work of statistics departments in planning for a HIES.

During the present study, the authors met with staff of most of the statistics departments in the region – and one of the topics discussed was the use of the HIES for fishery purposes. Talks were also held with the HIES specialist in SPC's SDD.

One of the HIES-related features to emerge from those discussions is that the published reports from a HIES often do not contain information from which various types of fishery estimations can be made. It appears to be a situation where those estimates come from an analysis of unpublished HIES information, often undertaken by SDD staff. Access to the unpublished information (either straight from a national statistics department or through SDD) requires the authorisation of senior staff of the statistics departments. For various reasons (including the recent politicisation of HIES results), that authorisation is often difficult to obtain. The net result is that in recent years it has become increasingly difficult to obtain the HIES data required for fishery purposes in many PICTs, at least for outside research such as the present Benefish study.

# 30 The Contribution of Fishing to GDP

Why should attention be given to the contribution of fishing to GDP? With all its imperfections and limitations, GDP is still a useful tool for determining the relative importance of an economic sector to a national economy. Changes in a sector's contribution to GDP can help determine whether recent sector-specific policies and initiatives are effective. Furthermore, the governments of many PICTs pay close attention to a sector's GDP contribution and associated changes when making decisions on budgetary allocations. Specifically for fishing, the sector is often not well understood by the national account specialists who estimate the fishing contribution to GDP. Experience from the present and past Benefish studies shows that this can often result in errors that disadvantage the sector – which can be rectified by individuals who have knowledge of the interface between fishing and GDP.

## 30.1 The official contribution

In the country sections of this report, the official GDP and the official fishing contribution to GDP are given. Methods used in the official calculation of the fishing contribution to GDP are also presented (when available), and some comments are made on the suitability of those methods.

Other sections of this report contain general information on GDP (Introductory chapter), national accounting and the fisheries sector (Appendix 2), and guidelines for calculating the fishing contribution to GDP (Appendix 3).

For each of the PICTs, the official data on GDP and associated fishing contributions are summarised in Table 30-1.

**Table 30-1:** Official estimates of GDP and fishing contribution to GDP

| | GDP (current market prices; local currency; '000s) | Fishing GDP contribution (local currency, '000s) | GDP (US$; '000s) | Fishing GDP contribution (US$; '000s) | Fishing as a % of GDP | Year and status of GDP estimate | Comments |
|---|---|---|---|---|---|---|---|
| Cook Islands | 463,300 | 2,000 | 315,170 | 1,361 | 0.4% | 2021 | The sector is referred to as "Fishing (including pearls)" |
| FSM | 227,700 | 17,600 | 227,700 | 17,600 | 7.7% | FY 2018 | GDP contribution excludes foreign-owned, locally based fishing vessels; includes the operations of DSG and CFC |
| Fiji | 8,895,900 | 66,800 | 4,196,179 | 31,509 | 0.75% | 2021 (provisional) | The sector is referred to as "fishing and aquaculture" |
| Kiribati | 302,793 | 24,192 | 219,415 | 17,530 | 8.0% | 2021 (provisional) | The fishing sector has 4 sub-sectors |
| Marshall Islands | 259,500 | 54,500 | 259,500 | 54,500 | 21.0% | FY 2021 | The GDP contribution excludes the locally based offshore fishing vessels |
| Nauru | 186,000 | 3,700 | 134,783 | 2,681 | 2.0% | FY 2020 | |
| Niue | 43,536 | --- | 29,616 | --- | ---- | 2018 | The fishing contribution is aggregated with agriculture, with the disaggregated contribution not readily available |
| Palau | 217,800 | 4,300 | 217,800 | 4,300 | 2.0% | 2021 (provisional) | The GDP contribution excludes the locally based offshore fishing vessels |
| PNG | 82,500,000 | 1,264,000 | 23,504,274 | 360,114 | 1.5% | 2020 | Fishing sector has 2 sub-sectors: formal and informal |
| Samoa | 2,191,200 | 37,400 | 846,023 | 14,440 | 1.7% | 2021 | Fishing sector has market & non-market components |
| Solomon Islands | 12,617,000 | 765,400 | 1,567,329 | 95,081 | 6.07% | 2020 (provisional) | Fishing sector is made up of the formal sector and the informal sector, with the latter made up of monetary fishing (outboard motor fishing; and gathering other marine products) and subsistence fishing |
| Tonga | 1,068,862 | 23,421 | 468,799 | 10,272 | 2.2% | 2020/21 (provisional) | Fishing sector has market, non-market and export components |

| | GDP (current market prices; local currency; '000s) | Fishing GDP contribution (local currency, '000s) | GDP (US$; '000s) | Fishing GDP contribution (US$; '000s) | Fishing as a % of GDP | Year and status of GDP estimate | Comments |
|---|---|---|---|---|---|---|---|
| Tuvalu | 77,938 | 2,667 | 56,477 | 1,933 | 3.4% | 2019 | |
| Vanuatu | 104,929,000 | 689,000 | 928,000 | 6,094 | 0.66% | 2020 | Fisheries production is from the 2006 Agriculture Survey |
| American Samoa | 709,000 | --- | 709,000 | --- | --- | 2021 | Official fishing contribution to GDP (if any) not available |
| French Polynesia | 626,899,000 | 12,216,000 | 5,949,502 | 115,934 | 1.95% | 2018 | Fishing sector has pearl culture, non-pearl aquaculture and fisheries components |
| Guam | 6,123,000 | --- | ---- | | --- | 2021 | Official fishing contribution to GDP (if any) not available |
| New Caledonia | 862,551,000 | 2,120,000 | 8,185,926 | 20,120 | 0.2% | 2017 | Fishing sector has shrimp aquaculture, offshore fishing, professional fishing and non-professional fishing components |
| Northern Mariana Islands | 1,182,000 | --- | 1,182,000 | --- | ---- | 2019 | Official fishing contribution to GDP (if any) not available |
| Pitcairn | --- | --- | --- | --- | --- | --- | No official GDP estimates are made |
| Tokelau | 14,042 | --- | --- | --- | --- | 2015/16 | The fishing contribution is aggregated with agriculture, with the disaggregated contribution not readily available |
| Wallis and Futuna | 18,000,000 | --- | 170,827 | --- | --- | 2005 | Official fishing contribution to GDP (if any) not available |

Source: Country sections of this report

The contribution of fishing to the official GDP is shown graphically in Figure 30-1 (absolute amount of money contributed) and Figure 30-2 (fishing contribution as a percentage of the entire GDP). Some caution is required in making comparisons across the countries. Ideally, the comparison would be for 2021 in all cases, but for several PICTs GDP information for that year is not yet available. For five of the countries in the table above, GDP information is provisional – and subject to change. The information in the graph below is therefore imperfect – and subject to change as better data become available.

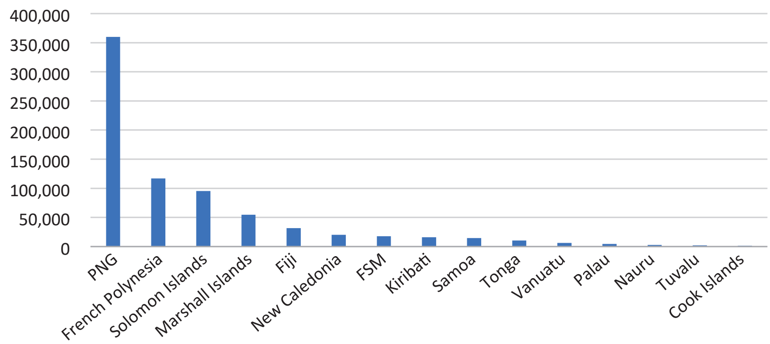



**Figure 30-1:** Contribution of fishing to GDP (US$ thousands) (for 2021 or latest year available). Source: Table 30-1 above

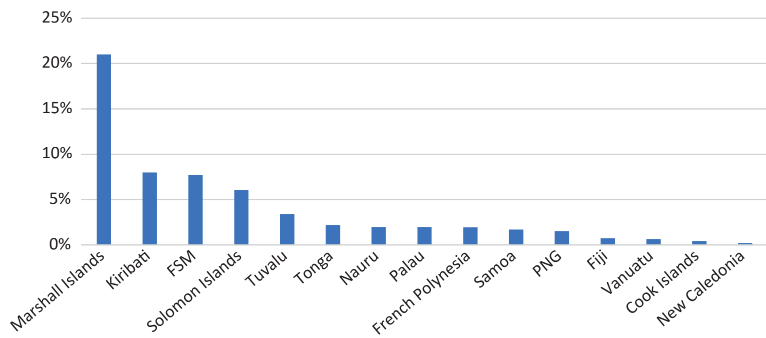



**Figure 30-2:** Percentage contribution of fishing to official GDP (for 2021 or latest year available). Source: Table 30-1 above

Some notable points about the two figures are:

- The reason for the high rank of the Marshall Islands in the second graph is that the individuals dealing with the national accounts of the Marshall Islands have decided to include the value added from the shore operations of major fishing companies as part of the Marshall Islands fishing sector. While agreeing that those operations are part of the Marshall Islands economy, the present study feels that those operations are not part of the strictly defined fishing sector.
- The relatively low rank of Kiribati, Nauru and Tuvalu in the first figure is because the large amount of foreign-based fishing in their zones is not considered part of their economy and therefore does not contribute to their GDP.
- The relatively high rank of French Polynesia and New Caledonia in the first graph is because of the high value of pearl culture and shrimp culture, respectively.
- The relatively low rank of New Caledonia in the second graph is because of the large size of the New Caledonia economy – the second largest in the region after PNG. A similar comment could be made about Fiji.

In some of the countries, the methods used to calculate the fishing component of GDP were well documented. In others, this information was obtained verbally during the present study. It is likely that at least some of this verbal information was inaccurate for various reasons, including the provider being unfamiliar with the subject. This should be taken into account when considering comments on any weaknesses in the methodology used in the various countries.

During the process of investigating the fishing contributions to GDP and associated methodology in the 22 PICTs, certain features and patterns emerged. One of the most common features to emerge concerns the individuals that work on national accounts. In many of the PICTs, the individuals responsible for calculating the fishing contribution to GDP (who are sometimes responsible for all sectors) appear to be unfamiliar with the technical basis of the methods they used for determining the fishing contribution. According to discussions with several such individuals, methods presently being used were developed by colleagues who have since departed. A "recipe" is now being followed, but the rationale for many components is apparently not well understood by those individuals, as evidenced by their inability to explain the methodology used.

Other important issues that emerged are:

- Almost without exception there is a great deal of enthusiasm among the staff of the various national statistics agencies for learning more about the fishing sector and improving the estimation of its contribution to GDP.
- In the process of making fishing contribution estimates, in most countries there is limited or no involvement of people with expertise in fisheries. On the other hand, in two countries where there was involvement of Fisheries Department staff, that involvement was taken as proof of the validity of the results, irrespective of the skills and experience of the fisheries people.
- Many countries have recently had, or are expecting to have in the near future, outside technical assistance for their national accounts from the Suva-based Pacific Island Financial Technical Assistance Centre (PIFTAC). The three American territories have outsourced the estimation of GDP to the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce.
- A surprising number of GDP calculations dealing with fishing are done using input from a "specialised survey" or "informal survey", almost none of which are available for examination. The results of some of those surveys appear incorrect to the point of wondering whether a reasonable survey had indeed been undertaken (e.g. an extremely small value-added ratio for a type of fishing that uses low technology).
- Many countries use the results of "business surveys" or tax records or provident fund (social security) records to determine the value added of commercial fishing. While this may be appropriate for large enterprises, there is some question whether small-scale commercial fishing activity is captured by this methodology.
- The statistics departments of most PICTs divide up the fishing sector into smaller components for GDP estimation purposes. Those components supposedly have similar characteristics with respect to value added. Problems seem to occur when very dissimilar fisheries are aggregated into a single component (e.g. sea cucumber diving and reef gleaning) or when important fisheries are overlooked. A few countries feel compelled to use the fishery categories specified in the International Standard Industrial Classification of All Industrial Activities, which (at least in one case) leads to the aggregation of very dissimilar fisheries and consequently illogical categories, making value added estimations difficult.

## 30.2 Re-estimating the fishing contribution to GDP

The fishing sector is complex. It can include thousands of producers operating in many locations and using a wide variety of techniques. Crew are often paid in kind or receive a share of the catch rather than wages, and even when they do receive wages, collecting information on those wages can be difficult. Compared to other sectors of Pacific Island economies, such as government, manufacturing or tourism, calculating the contribution of fishing to an economy is a particularly difficult task.

As part of the present study, a re-estimate was made of the fishing contribution to GDP for each country. This represents an alternative to the official method of estimating fishing contribution to GDP. It is not intended that the re-estimate replace the official methodology, but rather the results can serve as comparator to gain additional information on the appropriateness and accuracy of the official methodology – and possibly a need for modification.

The re-estimate for each country and the associated methodology are given in the country sections of this report. The results are summarised and compared to the official estimate (where available) in Table 30-2, below. The re-estimate percentage contribution of fishing is simply the new fishing contribution divided by the official GDP. No attempt is made (unless otherwise stated in the country section) to adjust national GDP to account for any significant increase/decrease in GDP due to a re-estimated fishing contribution.

**Table 30-2:** Official estimates and re-estimates of fishing contribution to GDP

| | Official fishing GDP contribution (local currency, '000s) | Consultant's re-estimate of fishing contribution to GDP (local currency; '000s) | Official fishing contribution as % of official GDP | Consultant's re-estimate of fishing contribution as % of official GDP | Comments |
|---|---|---|---|---|---|
| Cook Islands | 2,000 | 3,566 | 0.4% | 0.8% | |
| FSM | 17,600 | 32,240 | 7.7% | 15% | Official GDP for 2018, alternative for 2021 |
| Fiji | 66,800 | 122,670 | 0.75% | 1.38% | |
| Kiribati | 24,192 | 47,184 | 8.0% | 15.6% | |
| Marshall Islands | 54,500 | 7,697 | 21.0% | 3.0% | |
| Nauru | 3,700 | 1,618 | 2.0% | 0.87 | Official GDP for 2020, alternative for 2021 |
| Niue | --- | 1,516 | ---- | ---- | No official estimate for fishing contribution |
| Palau | 4,300 | 8,319 | 2.0% | 3.8% | |
| PNG | 1,264,000 | 785,350 | 1.5% | 0.84% | Official GDP for 2020, alternative for 2021 |
| Samoa | 37,400 | 84,554 | 1.7% | 3.8% | |
| Solomon Islands | 765,400 | 654,400 | 6.07% | 5.2% | Official GDP for 2020, alternative for 2021 |
| Tonga | 23,421 | 38,631 | 2.2% | 3.6% | |
| Tuvalu | 2,667 | 3,499 | 3.4% | 4.8% | Official GDP for 2019, alternative for 2021 |
| Vanuatu | 689,000 | 1,606,530 | 0.66% | 1.53% | Official GDP for 2020, alternative for 2021 |

| | Official fishing GDP contribution (local currency, '000s) | Consultant's re-estimate of fishing contribution to GDP (local currency; '000s) | Official fishing contribution as % of official GDP | Consultant's re-estimate of fishing contribution as % of official GDP | Comments |
|---|---|---|---|---|---|
| American Samoa | --- | 1,280 | --- | 0.18% | No official estimate for fishing contribution |
| French Polynesia | 12,216,000 | 5,473,981 | 1.95% | ------ | No GDP estimate for 2021 |
| Guam | --- | 515 | --- | 0.01% | No official estimate for fishing contribution |
| New Caledonia | 2,120,000 | 3,605,217 | 0.2% | 0.36% | Official and alternative not comparable due to official being for 2017, alternative for 2021 |
| Northern Mariana Islands | --- | 1,446 | ---- | 0.12% | No official estimate for fishing contribution |
| Pitcairn | --- | 38 | --- | ---- | No GDP estimate |
| Tokelau | --- | 840 | --- | --- | No GDP estimate for 2021 |
| Wallis and Futuna | --- | 173,300 | --- | ---- | No official estimate for fishing contribution |

Source: Country sections of this report

An attempt is made below to compare the official contributions of fishing to GDP to the re-estimates (Figure 30-3). The comparisons are complicated due to many of the official estimates not yet being available for 2021. Reportedly, Covid has delayed the GDP estimation process in several countries. Recognising this difficulty, if the official and alternative estimations are not within two years, they are not shown on the graphs below.

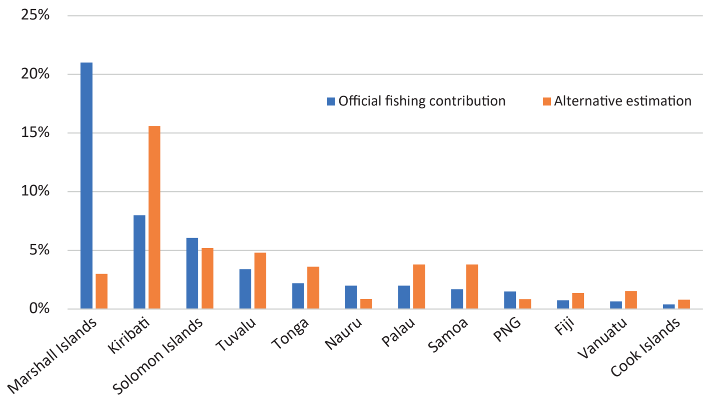



**Figure 30-3:** Official vs alternative estimations of fishing contributions to GDP (fishing contribution as a percentage of GDP). Source: Table above

For many of the countries, a discussion on the difference between official and alternative estimations is included in the GDP section of the country chapters of this book. The specific reasons for the differences (if known) are given in the country chapters of this book. Reasons for cases of large differences are given in the bullet points below, while more generalised explanations are given in the next set of bullet points.

The notable features of the above chart are:

- The alternative estimations of fishing contributions are larger than the official estimations in eight cases.
- The alternative estimations of fishing contributions are smaller than the official estimations in four cases.
- The large difference between the official and alternative fishing contributions in the Marshall Islands can easily be explained by the former including the shore-side operations of the fishing companies. While agreeing that those operations are part of the Marshall Islands economy, the present study feels that those operations are not part of the strictly defined fishing sector.

- The large difference for Kiribati is difficult to explain. The only readily available information on the methodology used for the 2021 fishing contribution is that a HIES was used to determine the value added of the informal fishing sector. In the 2016 Benefish study there was a similar situation and the study concluded:

  > The official contribution is much lower mainly because the "Informal sector fishing for cash sales" and "Informal sector fishing for subsistence" are about half of the corresponding amounts in the alternative approach. It also needs to be considered that the official approach does not include the contributions of offshore locally based fishing and aquaculture, other than seaweed.

- For Tuvalu, the methodology relies heavily on the recent HIES. The Technical Adviser to the Tuvalu Fisheries Department offers a possible explanation for why the official figure is lower (M. Batty, per. com. February 2023):

  > HIES uses only a sample of islands for the outer island production and the latest one did not include any of the lagoon islands which tend to have more fish – so it may also be an underestimate.

- For Palau, it is likely that the main difference is that the alternative calculation uses a much larger gross value for coastal fisheries production (both coastal commercial and coastal subsistence) than the official estimate.

On a more general level, some of the reasons for the difference between the official and the alternative estimates are:

- Including or excluding the activities of locally based foreign fishing vessels.
- The official estimates omitting certain important fisheries.
- For the GDP contribution from small-scale fishing (coastal commercial and subsistence fishing), there is often quite a difference between the official and re-estimate. In some cases, it is because estimates of value of production differ, and in others it is due to the value-added ratio being different.
- Estimating production from "informal" and "specialised" studies of the fishing sector in the official method often produces very different results from that obtained from the present study.
- The compilers of national accounts do not appear to have consulted the relevant fisheries agencies or the fishing industry when preparing their estimates.

## 30.3 Contributions to GDP by fishery sub-sector

In this study, re-estimates of fishing contribution to GDP for each country were done by uniform fisheries sub-sector categories across all PICTs. They are compiled and compared in the three figures below (30-4, 30-5 and 30-6).

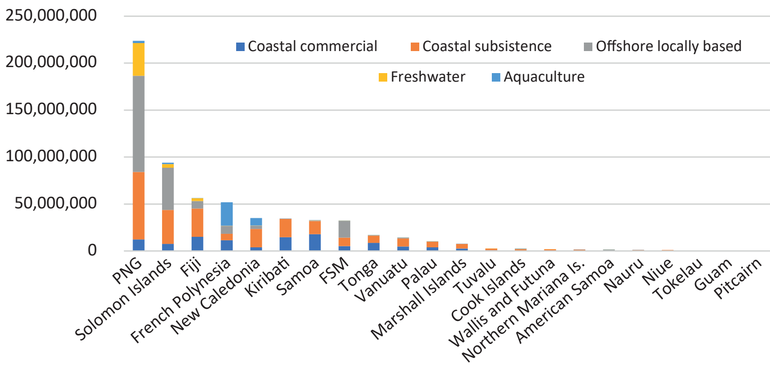



**Figure 30-4:** Contributions to GDP of each PICT by the various fishery sub-sectors (US$).
Source: Country sections of this report (2021 or latest available year)

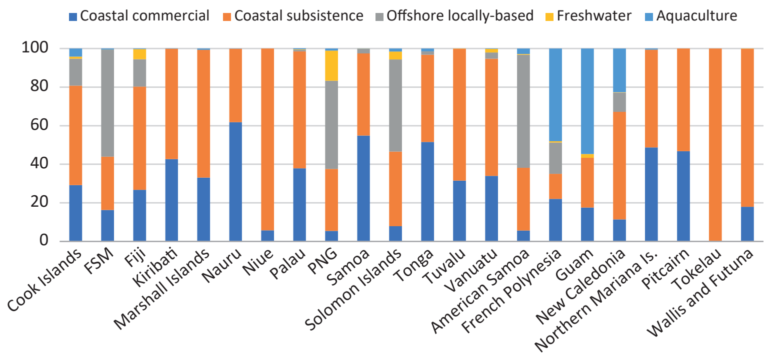



**Figure 30-5:** Contributions to GDP of the various fishery sub-sectors (%).
Source: Country sections of this report (2021 or latest available year)

Several observations can be made on the two figures above:

- As explained in Appendices 2 and 3, according to international GDP guidelines (i.e. SNA 2008), offshore foreign-based fishing does not contribute to the GDP of PICTs – hence that category of fishing does not appear in the two figures above.
- PNG is responsible for 40% of the fishing contribution to GDP in the region.
- Coastal subsistence fishing (the orange bars in the above figures) has a proportionally greater contribution to GDP than it does to total fishery production (as shown in the previous chapter) due to its characteristically high value-added ratio (i.e. relatively low inputs from other economic sectors such as those producing fuel, gear and boats).
- Similarly, freshwater fishing (yellow bars) is more prominent in the above figures than in the production graphs of the previous chapter due to the simplicity of fishing techniques and therefore high value-added ratio.
- In the first figure, the aquaculture contribution to GDP is only discernible for French Polynesia, New Caledonia and PNG, but it is much more visible in the second figure, suggesting relative importance of aquaculture is greater in the small countries and territories. Guam has the highest relative contribution of aquaculture to GDP due to the very small value of its coastal fisheries.
- Coastal commercial fishing has the highest relative contribution to GDP in Nauru, Samoa and Tonga. At least part of the reason for this is the low sophistication of the coastal commercial fishing techniques (hence a high value-added ratio) in those countries compared to that of places like French Polynesia, Palau and Guam.
- Because of its low value-added ratio, offshore locally based fishing assumes a lesser relative importance in GDP contribution than its contribution to catch value, as shown in the Production chapter of this book.

Figure 30-6 below gives the contribution percentage of the fishery sub-sectors to the total fishing contribution of the region. A striking feature of the pie chart is that it shows the importance of coastal subsistence fishing – despite often being given less prominence in national fisheries policies – to the economies of PICTs. Coastal fishing (both commercial and subsistence combined) has almost twice the contribution of locally based offshore fishing.

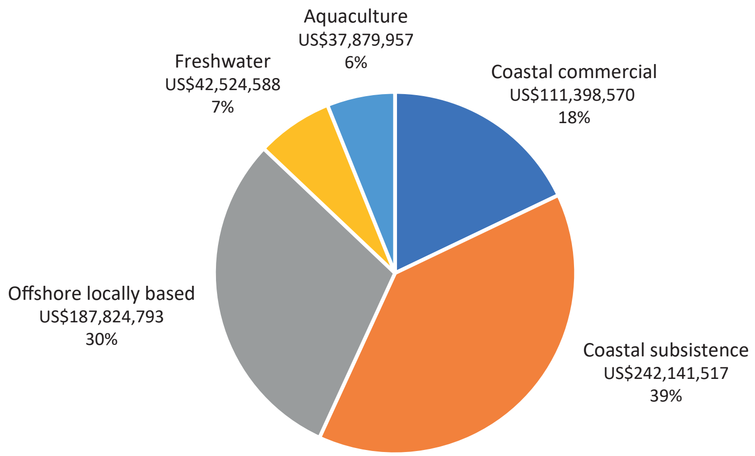



**Figure 30-6:** Consolidated regional contributions to GDP of the various fishery sub-sectors (%). Source: Country sections of this report

The contribution percentages of the fishery sub-sectors change over time. Figure 30-7 below shows how they have changed over three Benefish studies.

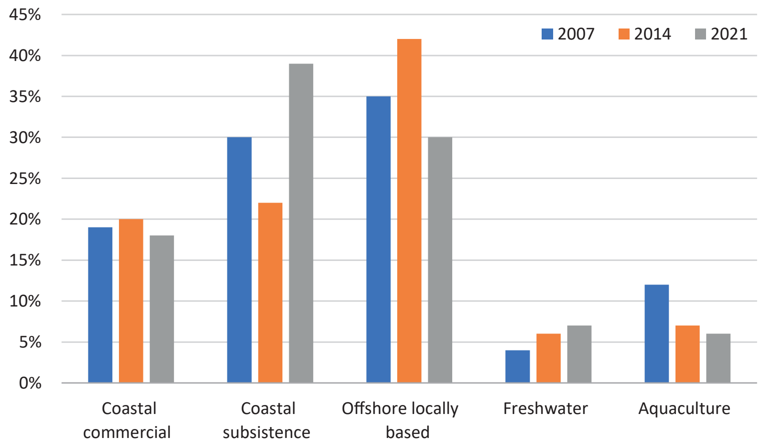



**Figure 30-7:** Consolidated regional contributions to GDP of the various fishery sub-sectors, 2007 vs 2016 vs 2021 (%). Source: Country sections of this report, Gillett (2016), Gillett (2009a)

Several observations can be made on the graph above:

- At least some of the change between 2014 and 2021 is due to the impact of Covid, which led to a dip in coastal commercial fishing and an increase in coastal subsistence fishing.

- The steady decline in the aquaculture contribution is largely due to the decrease in pearl production in French Polynesia and the Cook Islands. Another factor could be a problem mentioned in the aquaculture section of the production chapter of this book: that aquaculture has been severely affected by recent disasters (e.g. Vanuatu and Northern Mariana Islands).
- It is not clear why there was a dip in the coastal subsistence contribution in 2014.
- The increase in freshwater fishing contribution is mainly due to more realistic prices in the present study for freshwater fish in PNG, by far the largest producer.
- For the offshore locally based contribution, the spike in 2014 is likely due to an increase in the number of locally based offshore vessels, while the decline in 2021 is mainly due to reconsideration of whether some of those vessels are part of the economy of the country of basing.

## 30.4 Improving the official estimate of fishing contribution to GDP

General improvements to estimating GDP are far beyond the scope of the present project. However, there are some simple and obvious ways for improving the accuracy of the fishing contribution to GDP.

Based on the experience gained in four Benefish studies, two of the most practical ways for the staff of a statistics department to improve the estimates of fishing contribution to GDP are for those staff to:

- Compare the re-estimated fishing contributions in the country sections of this report to the official estimate and evaluate the differences and any need for modification to the methodology.
- Use the available technical expertise in fisheries when devising methodology, collecting data, making the estimate and reviewing the results. In addition to the government fisheries agencies, such expertise can be found in the regional agencies involved with fisheries, especially the Forum Fisheries Agency (FFA) and the Pacific Community (SPC).

When using the production approach for estimating fishing contribution to GDP:

- Formulate logical fisheries categories that group similar fisheries with similar value-added ratios. The present study uses the categories of coastal commercial, coastal subsistence, offshore locally based, offshore foreign-based, freshwater and aquaculture. Other categories may be more appropriate in some countries, while the smaller countries may have fewer categories.

- In the absence of specialised economic studies for the concerned country, use the suggested value-added ratios of Appendix 3 of this report.
- For estimates of offshore fisheries production, use the WCPFC national fisheries reports. All Pacific Island countries prepare these for the annual meeting of the WCPFC Scientific Committee (available at www.wcpfc.int). A spreadsheet compiled annually by FFA can place values on the tonnage of fisheries production in the WCPFC documents.

In the longer term – and on the level of the institutions supporting Pacific Island fisheries – there is some assistance that would be of considerable value in the interface between the fishing sector and national accounts. It is suggested that four issues be addressed: (1) value-added ratios, (2) the GDP status of locally based foreign fleets, (3) the blurring of the distinction between locally based and foreign-based offshore vessels, and (4) the value of a satellite account for fisheries.

More work needs to be done on the value-added ratios, particularly for industrial-scale offshore fishing. The simplified value-added ratios used in this and past Benefish studies were the best available at the time of the studies, but newer and better information on the finances of individual fishing companies may now be available through FFA studies and the work of statisticians/economists in Micronesia.

The GDP status of locally based offshore vessels is complex. There is a large range in the degree of integration of locally based offshore fishing operations into national economies, and the degree of integration of a single operation can evolve over time. The international standards for determining whether an entity should be included in a country's GDP (i.e. SNA 2008) were not developed with fishing in mind, nor do the concepts in those standards offer non-ambiguous guidance on dealing with offshore fishing. Currently, there is some debate amongst national account specialists on whether the value added of some locally based fleets should be included or excluded from the GDP of the country of basing. Some additional attention should be focused on this issue, and the possibility of developing regional guidelines should be considered.

A related issue (which would be quite important for future Benefish studies) is more carefully defining what a locally based offshore vessel is. In the early Benefish studies, it was the intention that the term would describe vessels that habitually return to the port of registry, offload catch and pick up supplies and crew (i.e. vessels that are integrated into the economy of the country of registration). In recent decades, the change in vessel operational patterns, the rise in transshipment in foreign areas, and incentives to re-flag in a Pacific Island country have blurred the distinction between locally based and foreign based offshore vessels. This issue – and its interaction with the Benefish methodology – will require additional attention in future studies.

Within the context of GDP, the development of a "satellite account" for fisheries may result in a greater appreciation for the fisheries sector (see next section).

## 30.5 A satellite account for fisheries

There may be considerable value in developing a "satellite account" for fisheries. The international guidance for national accounts (i.e. System of National Accounts [2008], International Standard Industrial Classification of All Industrial Activities) recognises the fishing sector – but that sector does not include post-harvest activities, which are quite important in many Pacific Island countries and likely to become more important in the future as PICTs strive to increase local shore-based activities associated with offshore fisheries. To rectify this situation, a satellite account could be constructed. Within the framework of the SNA, groups and sub-groups of industries can be identified and aggregated to form a satellite that is linked to, but not actually a part of, the main national account. Satellite accounts have been constructed for many clusters of related industries, including information and communication technologies (Australia), ocean industries (Nova Scotia) and non-profit institutions (multiple countries). A tourism satellite account is the most widespread example, with over 70 countries having established one. Tourism is not an industry in the SNA/ISIC categorisation, but rather an amalgamation of activities in various sectors, such as transport and retail trade, etc. By constructing a tourism satellite account, the economic contribution of tourists can be measured. Thought should be given to constructing a satellite account for fisheries so that the value added of fishing, fish processing and related activities can be consolidated, and trends can be monitored.

There is a practical example from Fiji of the value of a fisheries satellite account (Box 30-1).

**Box 30-1:** A Fiji tourism satellite account vs the Fiji fishing sector

Satellite accounting presents an opportunity to demonstrate the importance of the broad fisheries sector in Pacific Island countries. It is therefore ironic that to date the satellite concept seems to have had the opposite effect – downplaying the importance of fisheries. In Fiji the satellite account that was constructed for tourism estimated a contribution to GDP of F$402 million in 2002, representing 11.2 percent of Fiji's GDP for that year (FIBOS 2008). This aggregated contribution has been compared by promoters of tourism to the contribution of other economic (i.e. to the narrow SNA "fishing" category contribution of F$102 million in 2002), to arrive at the unjustified conclusion that tourism is a certain percentage greater than other industries. A correct comparison would be between satellite accounts, but none exists for fisheries.

Source: Gillett (2017)

The construction of a formal satellite account results in information for decision-making that is credible, reliable, comparable and impartial. Presently, in many countries of the region the data that come the closest to serving the same function is information compiled by the fishing industry that government decision-makers often view as biased and/or self-serving. It appears that a satellite account would be most useful in a country where there is a sizeable fisheries industry, multiple developments planned that affect the industry, and various industrial sectors competing for government attention.

In 2017 FFA looked at the possibility of a simplified satellite account for fisheries in Fiji (i.e. a "proto-satellite account"). That exercise showed that Fiji's post-harvest fisheries activities in 2014 were responsible for a F$78.6 million GDP contribution. This results in the GDP contribution of the broad fisheries sector being about 67% greater than just the contribution of the narrow SNA fishing sector (Gillett 2017).

# 31 Exports of Fishery Products

The readily available information on the export of fishery products is presented in the country and territory chapters and is summarised in Table 31-1, below.

**Table 31-1:** Exports of fishery products from the Pacific Islands (2021 unless otherwise noted)

| | Nominal value (local currency) | Nominal value (US$) | % of all exports | Additional details |
|---|---|---|---|---|
| Cook Islands | 18,961,000 | 12,898,631 | 68.0 | The official export data show that pearl exports in 2021 were only NZ$34,000, whereas the 2021 annual harvest of pearls was estimated in the present study to be worth from NZ$262,000 to NZ$332,000. |
| FSM | 26,276,363 | 26,276,363 | 87.6 | Data are from 2019. A total of 93% of the fishery exports are "purse seine fish". |
| Fiji | 141,615,112 | 66,799,581 | 7.3 | A study of the fish trade in Fiji (Gillett and Musadroka 2019) shows that in the period 2016–2019, Fiji exported annually about 450 t of fish from coastal fisheries and 12,000 t of fish from offshore longlining. |
| Kiribati | 3,537,000 | 2,563,043 | 30.7 | There has not been any export of seaweed since 2017. The official export data do not include aquarium fish (worth A$1,431,147 in 2018) or live giant clams. |
| Marshall Islands | 85,000,000 | 85,000,000 | 78.2 | The exports given here do not include that of the substantial "cooler trade", in which fish are shipped to Hawaii as personal baggage on passenger flights. |
| Nauru | 0 | 0 | - | Currently, there are no formal exports of fishery products from Nauru. |
| Niue | 5,050 | 3,435 | 0.46 | The domestic longlining and associated exports ended in late 2017. |
| Palau | 319,000 | 319,000 | 16.34 | The non-commercial export of reef fish is large, with estimates of 104.8 t being exported through what is commonly known as the "cooler trade" of personal baggage on passenger flights. |
| PNG | 1,515,700,000 | 431,823,362 | 1.27 | Data are from 2020. Tuna exports (including canned) are 95% of all fishery exports. During the last year that had no export ban on beche de mer (2018), that commodity represented 74.3% of all non-tuna exports and 6.0% of all fishery exports. |
| Samoa | 12,523,000 | 4,835,135 | 17.0 | In recent years there were only six major export commodities, of which fish represents almost half of total exports, followed by nonu juice, beer, taro, coconut and virgin coconut oil. |
| Solomon Islands | 475,000,000 | 59,006,211 | 15.9 | The harvesting of sea cucumber has a major impact on the value of coastal fishery exports. During 2018 the season was open and SI$19 million of exports of beche-de-mer were reported. |

| | Nominal value (local currency) | Nominal value (US$) | % of all exports | Additional details |
|---|---|---|---|---|
| Tonga | 4,663,596 | 2,045,437 | 13.5 | There was a large drop in fishery exports in 2021. The lack of exports of snapper was responsible for much of the decrease. |
| Tuvalu | 0 | 0 | 0 | The official export statistics of Tuvalu do not have a separate classification for fish, but rather the aggregated category of "Live animals, animal products". In 2021 there were no exports in that category. |
| Vanuatu | 199,000,000 | 1,759,972 | 3.5 | The export of "live fish" (i.e. aquarium fish) ceased in 2018. |
| American Samoa | 353,215,000 | 353,215,000 | 99.5 | Data are from 2019. The fishery exports of American Samoa consist largely of canned tuna and by-products of canning. |
| French Polynesia | 6,723,000,000 | 63,803,739 | 72.0 | Pearl products are the most important export of French Polynesia (53% of all exports by value), ahead of fish (19%), coconut oil (7%) and vanilla (6%). |
| Guam | 78,118 | 78,118 | 0.04 | Given that Guam has a large amount of tourism and military activity and a small fisheries sector, the fishery exports of Guam have limited economic importance. |
| New Caledonia | 1,174,000,000 | 11,141,691 | 0.6 | The low percentage of the fishery exports is because New Caledonia exports huge amounts of nickel products. |
| Northern Mariana Islands | 0 | 0 | - | Fishery exports in the mid-2010s were limited to shrimp and shrimp broodstock. After a typhoon in 2015, the shrimp farms in CNMI were damaged and all production stopped. |
| Pitcairn | 0 | 0 | - | The only export of fishery products from Pitcairn is the catch that is sold to visiting vessels (cruise ships, merchant ship, yachts and fishing vessels). |
| Tokelau | 0 | 0 | - | Tiny amounts of exports of fish occurred many years ago. The current situation is that there are no authorised fishery exports from Tokelau. |
| Wallis and Futuna | 0 | 0 | - | There were no significant fishery exports of Wallis and Futuna in 2021. Occasionally in the past there were exports of trochus and sea cucumber. |

Notes: Data are for 2021, unless otherwise noted; prices are FOB; official data are used, when available.
Source: Country chapters of this report; some data irregularities are noted in the country chapters.

The nominal values in US dollars of fishery exports from Table 31-1 (above) are shown graphically in Figure 31-1. The data are for 2021, except where otherwise noted in the table.

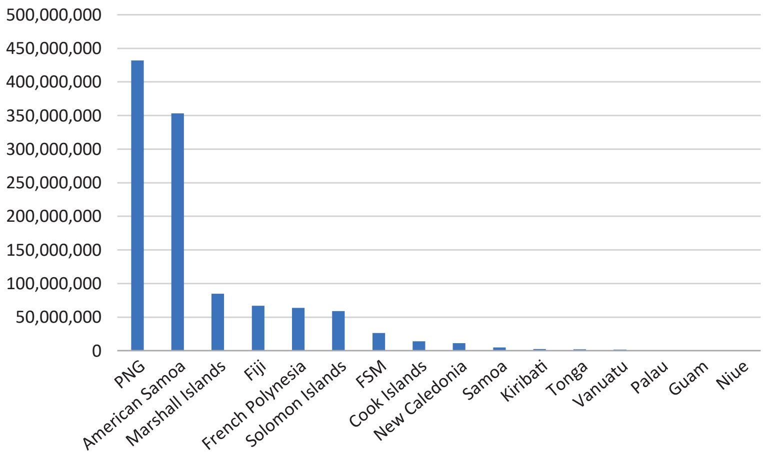



**Figure 31-1:** Value of fishery exports (US$).
Source: Table 31-1 above (2021, unless otherwise noted in the table above)

The relative importance of fishery exports (i.e. the value of fishery exports as a percentage of the value of all exports of a country) is given in Figure 31-2.

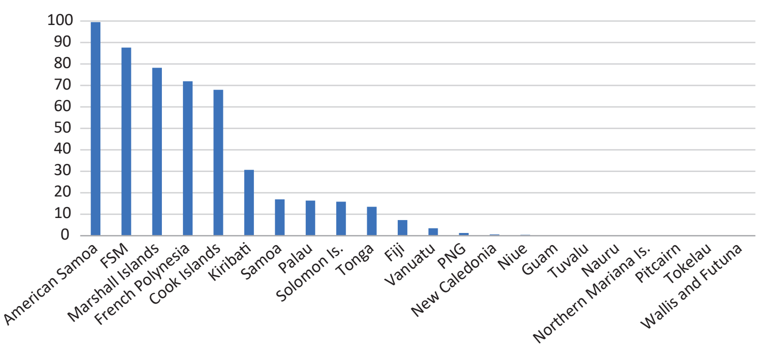



**Figure 31-2:** Relative importance of fishery exports (% of all exports).
Source: Table 31-1 above (2021, unless otherwise noted in the table above)

Perhaps the most important point to note from the above table and figures is that fishery exports are very important to some countries and territories in the region. In five of the countries/territories, fishery exports represent over 70% of the value of all exports. Where they represent less than 10% of all exports, several still remain quite large in nominal terms, namely PNG (US$432 million), Fiji (US$67 million), Solomon Islands (US$59 million) and New Caledonia (US$11 million). Other notable points evident from the table and figures are:

- The PICTs that have the largest values of fishery exports are American Samoa and PNG. Of the total US$1.1 billion of fishery exports from the region in 2021, about 70% is from these two places.
- The value of PNG's fishery exports is about 38% of the fishery exports from all of the PICTs combined.
- American Samoa's fishery exports are about 31% of the fishery exports from all of the PICTs combined. The single tuna cannery that is now operating (see Box 20-3 on tuna canning in the American Samoa chapter) is responsible for virtually all of those exports.
- The fishery exports of several countries/territories are very small or non-existent.
- Some large exporters of fishery products are countries or territories that export substantial amounts of other commodities (e.g. PNG and New Caledonia), making their fishery exports, although large, appear small in comparison to all their exports.
- Some large exporters of fishery products are countries/territories that export only small amounts of other commodities: Marshall Islands, French Polynesia and FSM.

## 31.1 Changes in the values of exports from 2014 to 2021

The 2016 Benefish study (Gillett 2016) gave the values of fishery exports for 2014. These values have been converted to 2021 prices[1] and compared in Table 31-2 (below) to the value of fishery exports in 2021 obtained from Table 31-1 (above).

**Table 31-2:** Changes in the value of exports, 2014 vs 2021

| | 2014 (in 2021 US$) | 2021 (in 2021 US$) | Change 2014 to 2021 (%) |
|---|---|---|---|
| American Samoa | 439,656,975 | 353,215,000 | -19.7% |
| PNG | 153,434,241 | 431,823,362 | 181.4% |
| French Polynesia | 119,181,290 | 63,803,739 | -46.5% |
| Fiji | 65,844,788 | 66,799,581 | 1.5% |
| Solomon Is. | 62,453,473 | 59,006,211 | -5.5% |
| New Caledonia | 25,244,268 | 11,141,691 | -55.9% |
| FSM | 22,344,217 | 26,276,363 | 17.6% |
| Marshall Islands | 16,644,000 | 85,000,000 | 410.7% |
| Palau | 13,110,000 | 319,000 | -97.6% |
| Tonga | 7,650,944 | 2,045,437 | -73.3% |
| Kiribati | 3,142,475 | 2,563,043 | -18.4% |
| Samoa | 2,653,004 | 4,835,135 | 82.3% |
| Vanuatu | 2,179,690 | 1,759,972 | -19.3% |
| Northern Mariana Islands | 812,250 | 0 | -100.0% |
| Cook Is. | 498,750 | 14,148,980 | 2,736.9% |
| Tokelau | 195,938 | 0 | -100.0% |
| Wallis/Futuna | 116,172 | 0 | -100.0% |
| Niue | 103,182 | 3,435 | -96.7% |
| Tuvalu | 33,773 | 0 | -100.0% |
| Pitcairn | 0 | 0 | 0.0% |
| Nauru | 0 | 0 | 0.0% |
| Guam | 0 | 78,118 | 0.0% |
| **Total** | **935,299,430** | **1,122,819,067** | **20.0%** |

[1] The difficulties of converting values for many different commodity types across the 22 Pacific Island countries and territories that have 10 different currencies are discussed in the Production chapter of this book (Chapter 29). A crude conversion factor of 1.14 is used here for converting 2014 prices to 2021 prices.

The changes in fishery export values from 2014 to 2021 are shown in Figures 31-3 and 31-4 below, where the countries/territories are separated into two groups – large exporters and small exporters – to enable the exports from the latter group to be discernible.

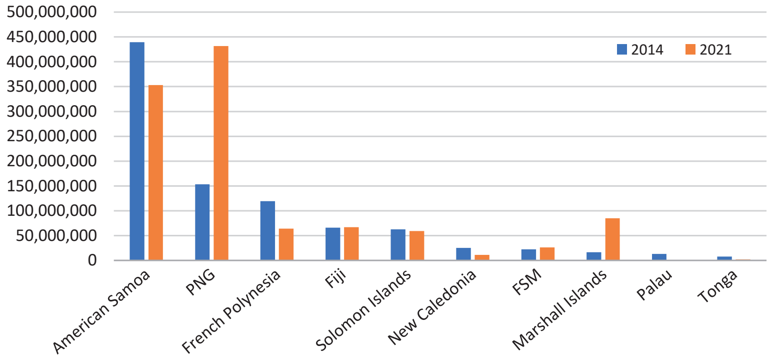



**Figure 31-3:** Comparison of fishery export values from the larger exporting countries, 2014 vs 2021 (US$ 2021 values). Source: Gillett (2016) and Table 31-2 above

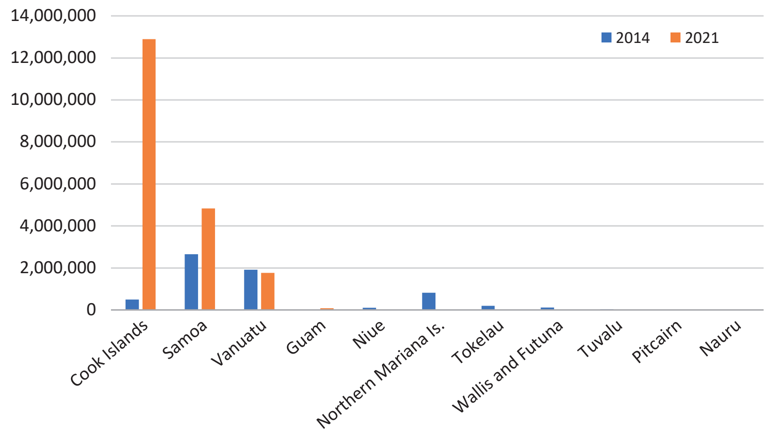



**Figure 31-4:** Comparison of fishery export values from the smaller exporting countries, 2014 vs 2021 (US$ 2021 values). Source: Gillett (2016) and Table 31-2 above

From the table and figures above, several observations can be made on the changes in fishery export values over the period 2014–2021:

- The total amount of fishery exports from the entire region increased in real value by about 20% over the period.
- This increase is remarkable considering that 2021 (a) was in the Covid period, (b) sea cucumber, a very high-priced commodity, was not harvested in that year in most PICTs, and (c) the exports from the cannery in American Samoa fell substantially in 2021.
- The rise in value of the fishery exports of PNG (up US$278 million) was responsible for about 68% of the rise in value of exports from the region. At least some of the increase was due to the Rebate Scheme – and therefore deserves additional attention (Box 31-1).
- Some of the biggest falls in exports during the 2014–2021 period (French Polynesia and New Caledonia) were due to declines in aquaculture.
- The large increase in fishery exports in the Cook Islands is questioned in the Cook Islands chapter in this book – which states that the exports seem too large in 2021 for the single small locally based longliner.
- Covid seems to have hit the smaller exporters more than the big tuna exporters. Although there are several exceptions, the supply chains for the non-tuna fishery products are mostly dependent on coastal commercial production – which are more affected by Covid. This is consistent with a statement in the Production chapter of this report:
- In general, during Covid many PICTs experience depressed coastal commercial production and moderately elevated coastal subsistence production. The impact of Covid on offshore fisheries operations was greatest in 2020, and by 2021 many (but not all) of those impacts were mitigated.

**Box 31-1:** Encouraging tuna processing/export by a rebate scheme in PNG

An increase in tuna processing and export reflects a rebate scheme approved by the National Executive Council in 2018 to encourage tuna processing in PNG and subsequent exports. Under the rebate, canning/loining operations are provided rebates on processed volumes rather than, as previously, vessel operators being provided discounts on VDS days.

When this scheme began, about half the PNG flagged vessels fled to FSM, Nauru and Korea, PNG processing jumped, PNG employment jumped, PNG revenue jumped, and subsidised fish to the Philippines dropped.

The PNG Fisheries Sector Executive Overview states "The direct government intervention in the processing sector through the rebate scheme has resulted in an overall increase in downstream and onshore processing by about 26%." A review of the rebate scheme indicated that in 2021 there was an increase of over 6,000 t of processed tuna compared to 2020 and export volume increased by 47 per cent.

Source: M. Brownjohn (per. com. March 2021), FFA (2022b), NFA (2022c)

## 31.2 Issues in measuring fishery exports

Several issues in measuring fishery exports were identified in previous Benefish reports. One of the most notable features is the apparent underestimation of the value of fishery exports. This underestimation appears large and relatively worse than in other trade sectors. In most cases, when the official export values are compared to other sources of similar information (e.g. importing country information, Convention on the International Trade of Endangered Species [CITES] records or audited exporting company accounts), the differences are remarkable. There are several possible reasons for the differences. Most government customs departments are oriented towards taxing imports and may give low priority to documenting exports. Some countries have no legal requirement for reporting exports, and they estimate fishery exports through indirect methods. Compared to other major commodities exported by PICTs, keeping track of fishery exports is more complex due to there being many exporters, a multitude of different products each with different values, large numbers of small shipments, and often there are different export points. In several PICTs there is no examination by customs departments of the exported fishery commodities.

Another issue in measuring fishery exports identified in previous Benefish reports is that in about half of the PICTs, the government fisheries agency monitors fishery exports independently of the government customs agency. This is presumably to gain more detail on fishery exports but could also be used as an enforcement tool (e.g. to prevent the export of banned species and sizes), a quality control measure and to supplement other fishery statistical systems, especially for coastal fisheries. All of these could be very useful in fishery management. However, in many countries these fisheries agency export data systems are not functional – they produce inaccurate information on exported fishery commodities, especially for coastal fisheries. Another issue is that the information is supposed to be made available to the public, but in several countries, it is very difficult to actually obtain the data or data summaries from staff of the fisheries agencies, and the information is often not available through annual reports. The requirement for exporters to participate in the export monitoring system (i.e. have export shipments inspected and obtain an export permit) creates extra work for both exporters and fisheries staff. Conceptually, the idea of a fisheries agency doing independent monitoring of fishery exports is good, but in most countries/territories of the region that do it, either poor or non-available information is produced at considerable expense. It seems logical that such export monitoring systems should be improved or abandoned.

The Harmonized Commodity Description and Coding System (HS)[2] used by most government customs agencies in the region to classify exports allows easy comparison of fishery trade across countries. It does, however, create problems for a detailed comparison of tuna products. For example, Fiji exports a large amount of tuna, but it is not possible to state exactly how much because some of the HS fish codes in the Fiji Bureau of Statistics export trade data could contain tuna and/or coastal fishery products. For example, the official trade statistics show that in 2020 a substantial amount of "Other fish fillet and fish meat (whether or not minced), fresh, chilled or frozen" was exported – a category that could include tuna and/or coastal fish.

Another problem in accurately quantifying fishery exports is that in many countries, products which would normally be considered fishery products are not being captured in the official export statistics:

- For some countries and territories, fishery exports are confined to finfish.
- Coral exports are not considered to be a fishery product in at least two countries.
- Some countries list a few important fishery exports and then lump other fishery products together with miscellaneous non-fishery commodities.

There are some inconsistencies in the export treatment of tuna transshipments. Most government agencies that monitor exports do not consider transshipments that occur in a country as exports of that country. Some agencies consider only those transshipments made by companies that are considered part of the domestic economy as exports of the country. Within a single country, different national or international agencies sometimes treat transshipments differently and hence have very different estimates of total exports. In the Forum Fisheries Agency (FFA) publication "Economic and Development Indicators and Statistics: Tuna Fisheries of the Western and Central Pacific Ocean" (Ruaia et al. 2020), the tuna exports for some countries include catch by their national fleets that may not have been landed onshore in the fleets' country.

Treating transshipment of fish as an export deserves additional attention. The International Merchandise Trade Statistics (IMTS) Pacific Compilation Guide 2021 (Lal 2021) was compiled by the Statistics for Development Division of the Pacific Community (SPC) to assist National Statistics Offices in

[2] Harmonized Commodity Description and Coding System (Harmonized System or HS) is an international nomenclature system for the classification of products which allows participating countries to classify traded goods on a common basis for customs purposes. The HS comprises approximately 5,000 article/product descriptions that appear as headings and subheadings, arranged in 97 chapters, grouped in 21 sections.

PICTs to collect, compile, analyse and report statistics on international trade in goods using a standard methodology. IMTS records all goods which add to or subtract from the stock of material resources of a country by entering (imports) or leaving (exports) its economic territory. The guide indicates several types of goods that should be excluded from being considered an import or an export of a country. Section 4.2.2 of the guide concerns goods that should be excluded, including "goods being transited (i.e passing through of goods from one place to another) and transshipped (offloading of goods from one ship and loading them onto another)".

As a general observation, in PICTs the customs departments produce more accurate summaries of the volume of total fish exports, while the fisheries divisions/departments are better at producing summaries of the species exported. As an example of the former, in Samoa the Customs Department, the Central Bank of Samoa and the Fisheries Division all record the fishery exports of Samoa. The information for each of the three agencies should be identical, but they are all different – with the Customs Department likely to have the most accurate data. This is probably because of the difficulties experienced by the other agencies in compiling summaries from a large number of export documents. As an example of the fisheries divisions/departments being better at producing summaries of the species exported, Table 31-3 below is from Fiji Customs Department data showing in detail the 2020 export of fishery items that are not even found in Fiji.[3]

[3] The items in the table are not re-exports as the original document has a separate category for re-exports.

Table 31-3: The erroneous recording of the export of fishery items from Fiji

| HS Code | Commodity description | Quantity | Unit | Value ($) |
|---|---|---|---|---|
| 03021900 | Other Salmonidae, excluding livers and roes | | | |
| | NZ New Zealand | 384 | kg | 8,080 |
| | Total | 384 | | 8,080 |
| 03031200 | Other Pacific salmon (*Oncorhynchus gorbuscha*, *oncorhynchus keta*, *Oncorhynchus tschawtscha*) | | | |
| | NZ New Zealand | 64 | kg | 640 |
| | Total | 64 | | 640 |
| 03031400 | Trout (*Salmo trutta*, Oncorhyn *chusmykis*s & *Oncorhynchus*) Chryso gaster | | | |
| | NZ New Zealand | 104 | kg | 1,248 |
| | Total | 104 | | 1,248 |
| 03031900 | Other salmonidae, excluding livers and roes | | | |
| | NZ New Zealand | 445 | kg | 2,757 |
| | Total | 445 | | 2,757 |
| 03032900 | Other trout | | | |
| | NZ New Zealand | 3,705 | kg | 43,636 |
| | Total | 3,705 | | 43,636 |
| 03036300 | Cod (*Gadus morhu*a, *Gadus omorhua*, *Gadus ogac*) | | | |
| | NZ New Zealand | 18 | kg | 438 |
| | Total | 18 | | 438 |
| 03047900 | Other frozen fillets of fish of the families Bregmacerotidae, Euclichthyidae and Muraenolepididae | | | |
| | NZ New Zealand | 100 | kg | 2,037 |
| | Total | 100 | | 2,037 |
| 03061200 | Lobsters (Homarus spp.) | | | |
| | NZ New Zealand | 1,243 | kg | 33,558 |
| | Total | 1,243 | | 33,558 |

Source: Unpublished data of the Fiji Revenue and Customs Service

Pearl exports are especially difficult to track. According to data from the Cook Islands Statistics Department, the declared value of pearl exports of the country in 2021 was NZ$34,000 [sic], whereas the 2021 annual harvest of pearls was estimated in the present study to be worth from NZ$262,000 to NZ$332,000. Tracking pearl exports, unlike that for many of the other fishery products, is complicated by the fact that pearls are often stockpiled when market conditions are poor, so the relationship between annual production and annual exports is not straightforward. There are various incentives for under declaring or not declaring pearl exports, including taxing pearl exports (French Polynesia) or a reluctance of pearl farmers to reveal to tax authorities the profitability of their culturing operation (many PICTs). The avoidance of declaring exports is quite easy as a substantial amount of pearls can be exported in the pockets of departing travellers.

# 32 Government Revenue from Fisheries

## 32.1 Access fees for offshore fishing

The term "access fees" is used here as revenue earned by a government for fishing activity from either foreign-based or locally based offshore vessels. The fishing activity that results in access fees was originally confined to that government's waters, but since the introduction of the purse seine vessel day scheme (VDS), revenue has also been obtained by governments from selling vessel days, sometimes resulting in a government earning money from fishing in another country's waters.

In the country and territory chapters of this book, information is provided on offshore access fees received by governments. Table 32-1 summarises the fees paid in 2021 (or most recent annual period for which data are available) and compares the fees to the total national government revenue. The access fees and their percentage contribution to total government revenue are shown in Figures 32-1 and 32-2, respectively.

Table 32-1: Access fees for offshore fishing in 2021 (or latest year)

| | Access fees (local currency) | Access fees (US$) | Access fees as % of government revenue | Other information |
|---|---|---|---|---|
| Cook Islands | 9,700,000 | 6,598,639 | 4.70% | For FY 2020/21 |
| FSM | 72,300,000 | 72,300,000 | 25.60% | For FY 2020; fees are an estimate by IMF |
| Fiji | 345,928 | 163,174 | 0.01% | For FY 2018/19 |
| Kiribati | 161,445,289 | 116,989,340 | 65.50% | For 2021 |
| Marshall Islands | 33,031,253 | 33,031,253 | 18.90% | For FY 2021; this is the money received by MIMRA |
| Nauru | 58,189,001 | 42,165,943 | 18.00% | For FY 2021/22 |
| Niue | 1,298,136 | 883,086 | 4.30% | For FY 2021/22 |
| Palau | 7,870,000 | 7,870,000 | 7.00% | Fees are for calendar year 2021; government revenue is for FY 2021 |
| PNG | 509,000,000 | 145,014,245 | 3.10% | For 2021 |
| Samoa | 2,900,000 | 1,119,691 | 0.37% | Fees are for calendar year 2021; government revenue is for FY 2021 |
| Solomon Islands | 338,987,149 | 42,110,205 | 8.90% | For 2020 |
| Tonga | 2,384,033 | 1,045,629 | 0.50% | For FY 2021/22 |
| Tuvalu | 43,678,261 | 31,650,914 | 76.30% | For 2021 |
| Vanuatu | 141,700,000 | 1,253,206 | 1.50% | For 2021 |
| American Samoa | 0 | 0 | - | |
| French Polynesia | 0 | 0 | - | |
| Guam | 0 | 0 | - | |
| New Caledonia | 0 | 0 | - | |
| Northern Mariana Islands | 0 | 0 | - | |
| Pitcairn | 0 | 0 | - | |
| Tokelau | 18,522,000 | 12,600,000 | 49% | Fees are for 2021; government revenue is for 2020 |
| Wallis and Futuna | 0 | 0 | - | |
| **Total access fees** | - | **514,795,325** | - | |

Source: Country chapters of this book

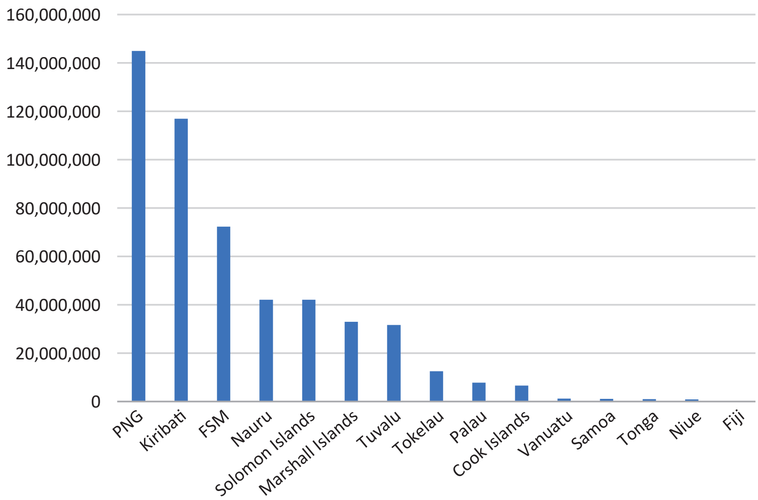



**Figure 32-1:** Access Fees (US$) in 2021 or most recent year available. Source: Table 32-1 above

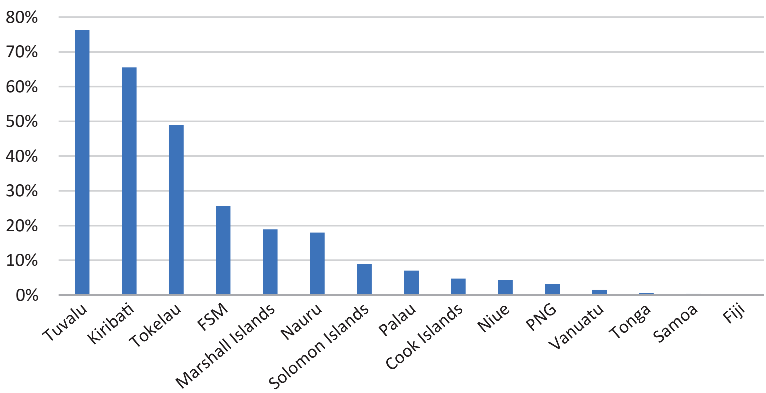



**Figure 32-2:** Access fees as a percentage of total government revenue in 2021 or most recent year available. Source: Table 32-1 above

There are several caveats and explanations required for the information in the table and figures:

- As the above table and figures deal with access fees for offshore fishing, an attempt has been made to remove any access fees paid by coastal fishing vessels. In some countries, coastal fishing vessels (e.g. bottom fishing vessels) pay access fees which are lumped in reports with that for offshore fishing, and disaggregating for this study was not always possible – but in any case, they are likely to be very small relative to access fees for offshore fishing.

- The annual periods associated with fee payments and government revenue in many cases do not always correspond precisely (e.g. a calendar year vs a financial year). For some countries, the fees are from one year and the government revenue is for a different year. Given the limited information available, this is unavoidable.
- "Government revenue" is defined in various ways in the different countries and territories. More information on what is included in government revenue (if available) is given in the country chapters.
- The access fees are mostly taken from government fishery agency documents and/or government finance agency documents in the public domain.
- In at least two Pacific Island countries, there are two ways to measure access fees: (1) the money that is received by the government fisheries authority, and (2) the money that the agency eventually turns over to the government. In the table above, where possible to determine, it is the money received by the authority.
- Some Pacific Island countries consider that all payments under the U.S. Tuna Treaty are for fishing access, while others treat some components as aid. Unless otherwise stated in a government document, all U.S. tuna treaty payments are assumed to be for access.

In considering the table and graphs, it should be noted that comparing access fees between countries is not always a true indicator of "success" as many countries have another (sometimes competing) objective, such as the development of a domestic tuna industry. Often, concessions in access fees have been granted (or are being offered) to stimulate benefits such as increased employment and exports that can flow from domestic tuna industries (e.g. FSM, Marshall Islands, PNG and Solomon Islands). Comparing dissimilar types of benefits (e.g. 100 jobs vs 1 million dollars in access fees) is complex.

Some observations can be made on the above table and graphs:

- For the year 2021, offshore fishing access generated a total of US$514,795,325 in revenue for the 22 PICTs.
- Because there are no offshore access fees in most territories, the access revenue-generating PICTs are the independent Pacific Island countries plus Tokelau.
- The top seven countries in terms of access fee generation are all Parties to the Nauru Agreement (PNA) members and are mostly small countries located in the equatorial region.

- PNG and Kiribati together are responsible for over half of the regional access fees.
- Although PNG obtains the most access fees of any PICT, the country is relatively low on the scale of access fees as a percentage of government revenue due to the large size of the PNG economy.
- For the PICTs in which access fees were responsible for more than 10% of government revenue, almost all are countries made up of atolls, which characteristically have limited opportunities for economic development.
- Niue generated 4.3% of all its government revenue from access fees in 2021, even though zero offshore fishing occurred in Niue waters in that year.

The information on access fees comes mainly from government fisheries and finance agencies. At least two fisheries specialists in the region have expressed the opinion that information generated by fisheries agencies is likely to be more accurate than that by finance agencies due to finance agencies not always knowing the origin of revenue deposits. While this may be true, the access fee information from finance agencies is usually from audited accounts. In several countries, differences in access fees between fisheries and finance agencies appear to be growing smaller over the period covered by Benefish reports. This could be due to periodic formal reconciliations of fees, for example, the series of reports "Fishing License Revenues in Kiribati" by the Ministry of Finance and Economic Development and the Ministry of Fisheries and Marine Resource Development.

Much has been written about the advantages of government fisheries authorities in the region – and there are many genuine positive aspects of authorities. One drawback of authorities as compared to conventional fisheries departments concerns the transparency of access fees. In two of the three fisheries authorities in the region, recent access fees are not generally available in the public domain.[1] By contrast, in countries where there is a fisheries department, access fees are generally listed in the national government budget, which is a public document.

Access fees for offshore fishing can be compared to the value of the offshore catch. Although this cannot be done for the present study for individual countries due to how the offshore catch data were collected[2], it can be done on a regional basis. From the table above the access fees received in 2021 (or the latest year for which data are available) for all the PICTs are estimated to be US$514,795,325. In the Production chapter of this book, the value of the offshore catch of all PICTs in 2021 was estimated to be US$1,915,004,397. This

[1] In one fisheries authority, the access fees are clearly laid out in the annual report of the authority, whereas in the other two authorities, the production of timely, comprehensive annual reports is not given high priority.

[2] The production chapter of this book explains the complications of determining total offshore catch in a country by having the catch categories of "offshore locally based" and "offshore foreign-based".

equates to the access fees for offshore fishing being 26.8% of the value of the regional offshore catch.

Other estimates of the offshore access fees as a percentage of the offshore catch have been made:

- The 2021 PNA purse seine catch was worth $2,076,000,000 and VDS revenue was $471,000,000, equating to 22.7% (L. Clark, per. com. March 2023)
- According to the 2022 Tuna Report Card (FFA 2022a), in 2021 money from license and access fees collected by Forum Fisheries Agency (FFA) member governments is estimated to be $480 million for a regional catch valued at US$2,487,000,000, equating to 19.3% of the value of the offshore catch (Box 32-1).

In comparing the regional access fees to the regional value of the catch for the two studies bulleted above and the present study, it is important to note that the composition of what is being compared is quite different among the three studies. Although the FFA study and the present study include the same countries[3], the PNA study has a very different country composition and was concerned with access fees for purse seining only. In many cases, FFA estimated the catch value for several countries using a historical formula, whereas the present study did in-country research to attempt to locate documents giving actual money received. The main difference between the FFA study and the present study likely concerns valuing the catch. The FFA uses "delivered values" (i.e. the value in an Asian port), whereas the present study uses the in-zone value.[4] A crude calculation shows the in-zone value to be about 15% less than the delivered value, which if applied to the Tuna Report Card results above, gives a percentage of access fees to catch value surprisingly close to that of the present study.

[3] The PICTs that generate access fees from offshore fishing (i.e. independent countries plus Tokelau) are the same as the FFA Pacific Island member countries.

[4] The in-zone value is used for two reasons: (1) the best measure of economic value to a fisher occurs where the fish is caught – not somewhere down the value chain, and (2) the present study encompasses other fisheries such as coastal commercial and aquaculture, where the values are either the "beach price" or the farm gate prices – and for comparison purposes a similar type of value methodology must be used for the offshore fisheries. The present study uses FFA tuna destination prices minus the cost of getting to those market (i.e. less the transshipment charges).

**Box 32-1:** A comment on 2021 offshore access fees from the FFA Tuna Report Card

In 2021, government revenues from license and access fee revenue collected by FFA member governments is estimated at $480 million, similar to 2020 although 4% lower than for 2018 when access fee revenues peaked at $498 million. After a decade of rapid growth, access fee revenue between 2017 and 2021 were relatively stable in the $480 to $498 million range. While the Taskforce's target of a 25% increase in government revenue from access and licensing fees was not achieved, it is important to note that for the purse seine fishery, which provides the overwhelming majority of these revenues, the rate of return (access and licensing fee revenue as a percentage of the value of the catch) in 2015 was in excess of 20% and that a similar rate of return continues to be achieved. This rate of return compares favorably with that earned in other global fisheries. It is also worth noting that a number of factors have likely placed downward pressure on access fees in recent years, including relatively low fish prices, significant operational and supply chain distributions resulting from the implementation of COVID-19 mitigation measures and the increase in the proportion of fishing activity undertaken by national fleets which typically pay lower unit access fees than foreign fleets.

Source: FFA (2022a)

Table 32-2 below uses the access fees from Table 32-1 (excluding the outliers) to make some comparisons.

**Table 32-2:** Access fees: Some comparisons

| | Annual access fees (US$) | Annual access fees per resident (US$) | Annual access fees per km$^2$ of 200-mile zone (US$) | Other information |
|---|---|---|---|---|
| Cook Islands | 6,598,639 | 430 | 4 | |
| FSM | 72,300,000 | 80 | 24 | |
| Fiji | 163,174 | 1 | 0 | No foreign fishing but access fees from U.S. Tuna Treaty |
| Kiribati | 116,989,340 | 2,146 | 33 | |
| Marshall Islands | 33,031,253 | 312 | 16 | |
| Nauru | 42,165,943 | 3,564 | 132 | |
| Niue | 883,086 | 570 | 2 | No foreign fishing but access fees from U.S. Tuna Treaty |
| Palau | 7,870,000 | 438 | 13 | |
| PNG | 145,014,245 | 16 | 46 | |
| Samoa | 1,119,691 | 6 | 9 | No foreign fishing but access fees from U.S. Tuna Treaty |
| Solomon Islands | 42,110,205 | 58 | 31 | |
| Tonga | 1,045,629 | 11 | 1 | |
| Tuvalu | 31,650,914 | 2,964 | 35 | |
| Vanuatu | 1,253,206 | 4 | 2 | |
| Tokelau | 12,600,000 | 8,394 | 43 | |

Source: Table 32-1 and other sections of this book Period: 2021 or latest year for which data are available

The results from the table are shown graphically in the following two figures.

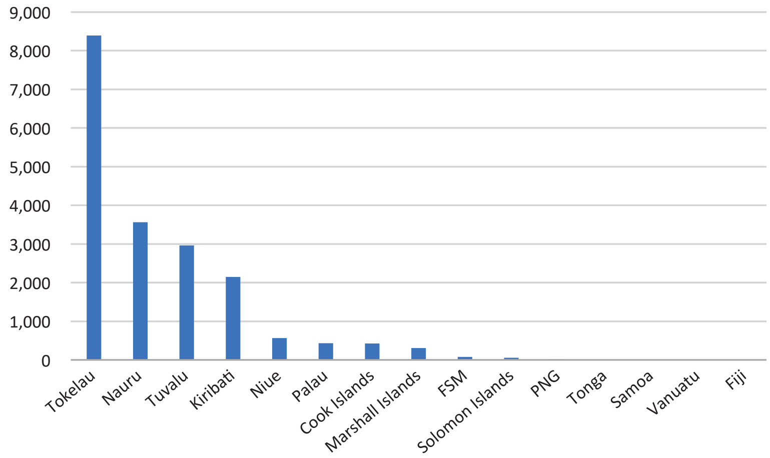



**Figure 32-3:** Annual access fees per resident (US$)
Source: Table 32-2 (2021 or latest year for which data are available)

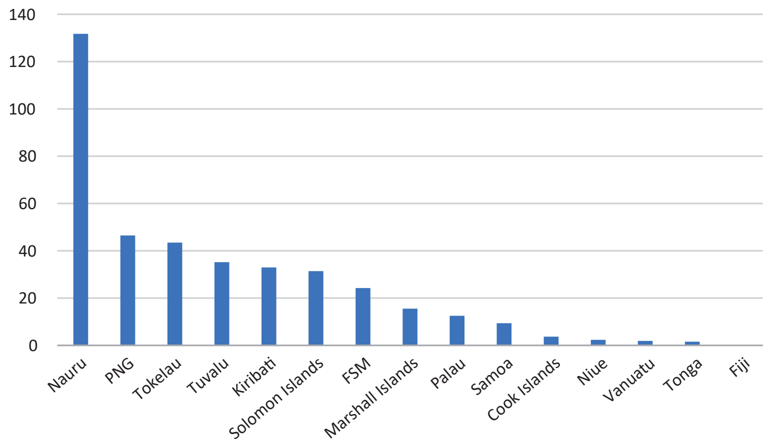



**Figure 32-4:** Annual access fees per square kilometre of 200-mile zone (US$)
Source: Table 32-2 (2021 or latest year for which data are available)

The comparisons above between access fees and the number of residents and size of zones represent just one data point for each country. Given the characteristic variability of tuna catches in a national zone, a more informative approach would be to make the comparisons using data over several years – but such information was not available for several countries. Where it does exist, it is given in the country and territory chapters and available for further analysis by interested parties.

Some observations can be made on the above table and figures:

- In 2021 four countries of the region received access fees that equated to more than US$1,000 per capita.
- Kiribati and PNG, despite having some of the largest 200-mile zones in the region, had relatively high access fees per $km^2$ of zone in 2021.
- Some countries (e.g. FSM and PNG) have tuna industry development policies in place and are not solely focusing on maximising access fees. Similarly, other PICTs (Palau and Pitcairn) are promoting large pelagic marine protected areas, hence their relatively low position (or absence) in some of the graphs.
- Nauru had by far the highest access fees per $km^2$ of zone in 2021. This is similar to the country having the highest catch per km2 of zone in 2021, as stated in the Production chapter. This high density of access fees is due to a fairly small zone (320,000 $km^2$) and substantial access fees in 2021 (US$42 million).

Access fees were collected in a similar way during the earlier Benefish studies covering 2007 and 2014. In Table 32-3, those fees are converted to 2021 prices[5] and are compared to 2021 access fees in Table 32-1 and Figure 32-1.

[5] The difficulties of converting values over time for many different commodity types across the 22 PICTs with 10 different currencies are discussed in the GDP chapter.

**Table 32-3:** Changes in access fees 2007–2021

| | 2007 access fees (in 2021 US$) | 2014 access fees (in 2021 US$) | 2021 access fees (in 2021 US$) | % change 2007–2021 |
|---|---|---|---|---|
| Cook Islands | 298,680 | 350,352 | 6,598,639 | 2109% |
| FSM | 16,823,232 | 19,733,651 | 72,300,000 | 330% |
| Fiji | 292,963 | 343,645 | 163,174 | -44% |
| Kiribati | 24,351,784 | 28,564,643 | 116,989,340 | 380% |
| Marshall Islands | 2,227,154 | 2,612,451 | 33,031,253 | 1383% |
| Nauru | 5,868,605 | 6,883,874 | 42,165,943 | 619% |
| Niue | 300,941 | 353,003 | 883,086 | 193% |
| Palau | 1,278,260 | 1,499,400 | 7,870,000 | 516% |
| PNG | 17,061,486 | 20,013,123 | 145,014,245 | 750% |
| Samoa | 292,963 | 343,645 | 1,119,691 | 282% |
| Solomon Islands | 13,411,764 | 15,731,999 | 42,110,205 | 214% |
| Tonga | 150,715 | 176,789 | 1,045,629 | 594% |
| Tuvalu | 3,927,731 | 4,607,228 | 31,650,914 | 706% |
| Vanuatu | 1,550,058 | 1,818,218 | 1,253,206 | -19% |
| Tokelau | 1,685,691 | 1,977,315 | 12,600,000 | 647% |
| **Total** | **89,522,026** | **105,009,335** | **514,795,325** | **475%** |

Source: Gillett (2009a) for 2007, Gillett (2016) for 2014 and Table 32-1 for 2021 fees

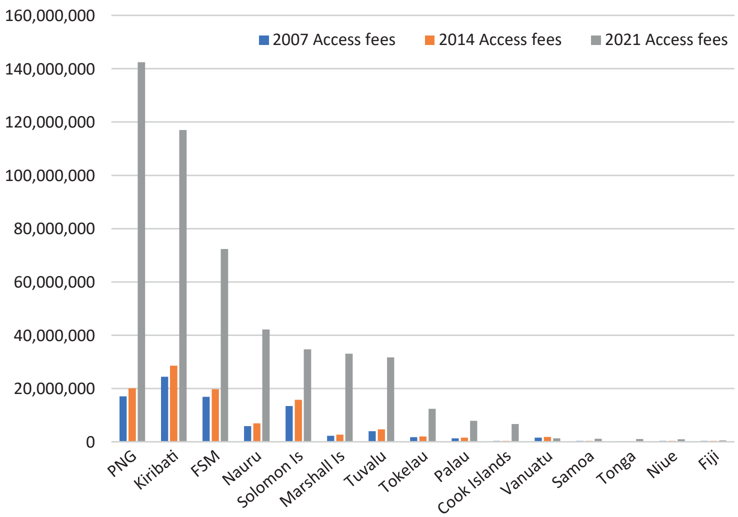



**Figure 32-5:** Changes in access fees 2007–2021 (US$). Source: Table 32-3

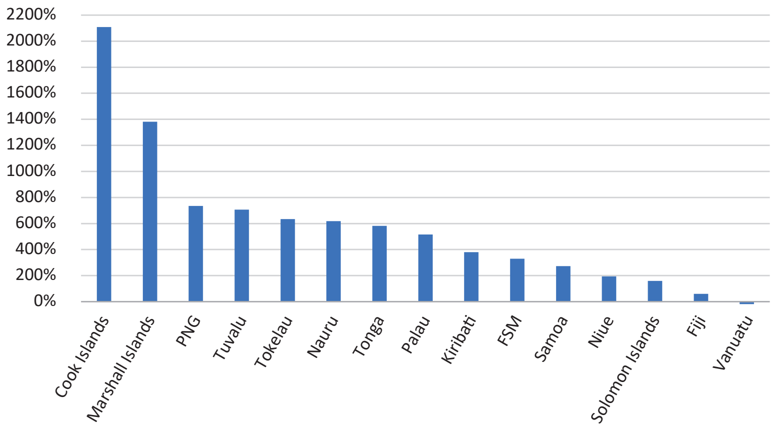



**Figure 32-6:** Percentage change in access fees 2007–2021. Source: Table 32-3

From the above table and figure, the following are evident:

- In the period 2007–2021, access fees increased in real terms in all countries that receive access fees, except Vanuatu, which had a drop between 2014 and 2021.
- The countries that had the largest increase in real access fees were mostly those that participate in the PNA purse seine vessel day scheme. The exceptions were two non-PNA countries, the Cook Islands and Tonga, for which access fees in 2021 were compared to very low levels of fees in 2007.
- Another aspect of changes in access fees between years is shifting tuna abundance associated with oceanographic conditions. El Niño causes a shift in purse seine production to the east (i.e. towards Kiribati), while La Niña causes a shift in production to the west (i.e. towards PNG and FSM). In terms of the years the Benefish studies took place, 2007 was a weak La Niña, 2014 was a weak El Niño, and 2021 was a moderate La Niña. While there is some shift in access fees with these oceanographic conditions, that shift is moderated to a degree by the purse seine vessel day scheme through transferability and pooling of vessel days.

Historical offshore access fees for the region – which were collected/expressed in the same manner – are readily available in the public domain for five periods:

- 2021: US$505 million (this study)
- 2014: US$349 million (Gillett 2016)
- 2007: US$78.5 million (Gillett 2009a)
- 1999: US$60.3 million (Gillett et al. 2001)
- 1996: US$66.3 million (Gillett 1997)

For context, 1982 US$15 million (Clark 1983) is added to this list.

Bearing in mind that these amounts are nominal access fees, they can be crudely converted to 2021 prices by a using a composite consumer price index (CPI) for the region (this is discussed in the GDP chapter of this book) and graphed (Figure 32-7).

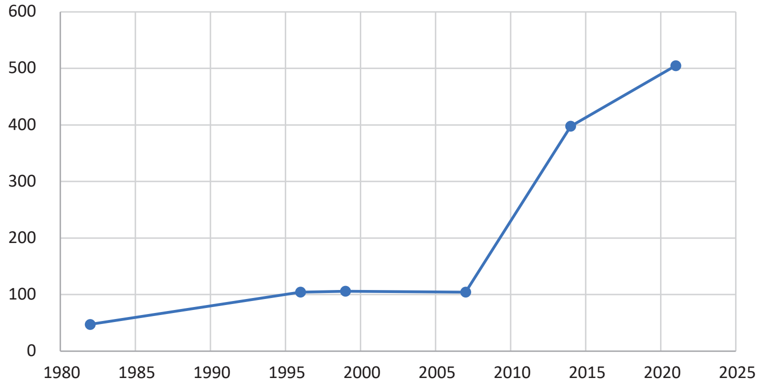



**Figure 32-7:** Real change in offshore access fees 1982–2021 (US$ millions)

A large change in access fees occurred between the 2007 and 2014 data points on the above graph. It is no coincidence that the implementation of the purse seine vessel day scheme was initiated and completed between those two dates. Officially, the vessel day scheme took effect from December 2007, but full implementation was not attained until 2012.

In the above graph, a feature of the access fees in the early years is that the fees came almost entirely from foreign fishing because there was little domestic offshore fishing activity during that period – and governments were trying to encourage what little domestic offshore fishing activity there was, rather than tax it. In recent years, the proportion of domestic offshore catch has increased remarkably, and according to the 2022 Tuna Fishery Report card, in 2021 the share of the offshore catch value taken by FFA members' fleets within their national waters was 56%. Now, many governments obtain offshore access fees from domestic vessels.

It should be stressed that access fees and their changes over time are an imperfect indicator of success as many countries use concessions in access fees to promote the development of a domestic tuna industry, which can yield other types of benefits (e.g. jobs in processing facilities).

## 32.2 Other government revenue from fisheries

In each country chapter of this book, there is a section providing the readily available information related to government revenue generated from the fisheries sector that is not related to fishing access fees. This information is summarised in Table 32-4.

**Table 32-4:** Government revenue from fisheries – other than offshore access fees

| | Information on other government revenue |
|---|---|
| Cook Islands | The only readily available information on revenue from the fisheries sector that is not related to access is that the Cook Islands received NZ$836,000 from "fishing fines" in the financial year 2020/21. |
| FSM | There is not much information readily available on government revenue from the fisheries sector, other than fishing access fees. In FSM, much of the non-access government revenue from the fisheries sector is acquired at the state level. It is likely state fees for tuna transshipment are the largest non-access source of government revenue. |
| Fiji | Fiji's Schedule 7 of Offshore Fisheries Management Regulations 2014 specifies the fees to be charged for 71 different items, including the Fiji vessel management and monitoring fee, observer levy, export permit, recreational fishing license fee and transshipment fee. For the 2018/19 financial year, a total of F$4,288,961 was received by the Fiji government from 13 types of fees charged by the Ministry of Fisheries. |
| Kiribati | The 2023 Recurrent Budget gives the non-access revenue for 2021 as: Fish transshipment fees: A$7,481,672; Local fishing: A$1,999; Fish and fish poster sales: A$984; Vessel and equipment hire: A$3,591; EEZ chart sales: A$3,385; Marine Scientific research: A$5,269. |
| Marshall Islands | The MIMRA FY 2021 Annual Report indicates that US$1,580,034 was received by MIMRA for observer fees, transshipment fees, fishing violations, boat charter fees and other. |
| Nauru | Information is not readily available on the Nauru government's revenue from fisheries that is not associated with offshore access. |
| Niue | No information is readily available on the amount of any such revenue in Niue. |
| Palau | The fish export tax is a significant source of direct government revenue from fisheries activities. In 2008 the tax rate was increased to US$0.35 per kg and was increased to $0.50 per kg in 2020. The tax resulted in revenue of US$157,463 in FY 2020. Other government revenue comes from an annual management fee for offshore vessels, the Marine Export Declaration Fee, CITES permits and marine research permit. Fishing license fees and fishing boat registration fees are charged by some of the states of Palau. |
| PNG | A limited quantity of information is available on government revenue from the fisheries sector, other than access fees. NFA (2022b) states that the revenue streams are access fees (94% of total), license fees (3%) and other (3%). |
| Samoa | Non-access sources of government revenue from fisheries are from licensing of domestic fishing vessels, licensing fisheries processing establishments, export certificates, market table renting, the sale of ice and transshipment. |
| Solomon Islands | Government revenue is generated from Fisheries License Fees (Local), Export Permit Fees, Fish Processing Licence Fees, Port Entry Fees, Fish and Miscellaneous Sales, Transshipment Levies, and Observer and Services Fees. In 2020, SI$67,256,674 was generated from these activities. |

| | Information on other government revenue |
|---|---|
| Tonga | Apart from the access fees, T$1,179,374 was received for sale of produce and products: sales of posters, supporting letters, licenses and rentals /resource rent. |
| Tuvalu | One of the major sources of non-access revenue from the fisheries sector is tuna transshipment. The transshipment levy was US$10.00 per tonne, but after Covid it was reduced to US$7.00 per tonne. In 2021, 69 transshipments yielded US$545,430. Other major sources of non-access revenue from the fisheries sector are the new vessel flagging arrangements (US$1.2 million in 2021) and the government's investments in joint venture fishing operations. |
| Vanuatu | In addition to the revenue from offshore fishery access, the Vanuatu government receives other revenue from international authorizations to fish, artisanal fishing licences, fish export establishment licences, sea cucumber processing licences, sea cucumber export licences and aquaculture licenses. In 2020 the above licences generated 5,600,000 vatu in revenue. In 2021 the amount was 6,020,000 vatu. |
| American Samoa | The Department of Marine and Wildlife Resources issues several fishing licences per month at a cost of US$10 per license. The revenue generated is deposited in the general fund of the government of American Samoa. Information on other forms of government revenue from the fisheries sector in American Samoa is not readily available. |
| French Polynesia | In general, in French Polynesia the fisheries sector is not revenue generating, but rather is subsidy absorbing. A variety of subsidies are available for the various fisheries sub-sectors. Examples are for longline fuel and the construction of coastal fishing vessels. There is a small tax on the export of pearls. Initially, the rate of taxation was XFP 200 per gram, but in 2009, it was changed to XPF 50 per pearl. |
| Guam | Any fishing licensing fees paid by vessels based in Guam go to U.S. government agencies, rather than to the government of Guam. |
| New Caledonia | In general, in New Caledonia the fisheries sector does not generate revenue for the government, but rather absorbs various types of government subsidies. |
| Northern Mariana Islands | According to financial information in the Division of Fish and Wildlife's 2019 Citizen Centric Report, the Division receives no money from fisheries licenses or fisheries-related fines. |
| Pitcairn | No information is available on other forms of government revenue from the fisheries sector. |
| Tokelau | The island administrators do not tax or license domestic fishing activity. |
| Wallis and Futuna | In Wallis and Futuna, the fishing sector is not revenue generating, but rather is subsidy absorbing. |

Source: Country chapters of this report

Several observations can be made on the information in the table. The most notable feature of the data is that it is highly variable and inconsistent across the countries and territories – different types of data, reported with varying degrees of rigour – and therefore not easily comparable. The listed items are essentially levies collected by the governments and are a combination of substantial government revenue (e.g. domestic fees), cost recovery for a service provided (e.g. CITES inspection permits), and payments for commercial activities of government fisheries agencies (e.g. money paid by exporters for giant clams raised by a fisheries department). Other notable points in the table are:

- The Pacific Island territories collect little, if any, non-access revenue – and (from a previous table) the only territory that collects access revenue is Tokelau.
- The fisheries sector in the French territories is typically not revenue generating, but rather is subsidy absorbing. In the U.S. territories, typically just a tiny amount of license fees is collected.
- Substantial export taxes on fishery products are only charged in Palau and the Solomon Islands, with a small amount being charged in Tonga. For the Solomon Islands, the original intention of the export tax was to prevent unfair transfer pricing by a vertically integrated fishing/marketing company.
- Substantial revenue from the fisheries sector presumably comes from personal and company taxation – but it appears that this information has not been compiled in any country or territory in the region (in contrast to tourism).

Total fees collected by a government for transshipment for 2021 were only readily available for four countries:

- Kiribati: US$5,421,501
- Marshall Islands: US$538,000
- Tuvalu: US$545,430
- Solomon Islands: US$315,748 (for 2020)

It is likely that with additional research, the amount of money received by each country in 2021 for transshipment could eventually be obtained. This highlights an important issue regarding fishery benefits across the region: in most countries and territories, the sector is not active in advertising its importance. In the tourism sector, for example, it is likely that a benefit of a magnitude similar to that from transshipping would be publicised with enthusiasm.

During the present study, a request to a large tuna trading company for tuna transshipment fees charged by PICT governments resulted in information on fees in the major transshipment ports of the region (Table 32-5).

**Table 32-5:** Government fees for tuna transshipment in the major transshipment ports

| Port name | Port fee | Anchorage fee | Pilotage fee | Transshipment fee | Transshipment license fee per year |
|---|---|---|---|---|---|
| Majuro | N.A | per vessel's GRT x US$0.05 | per vessel's GRT x US$0.10 per move | US$1,500 | US$10,000 |
| Pohnpei, FSM | N.A | US$224.65 per day | US$495.075 per service | N.A | US$1,800 |
| Rabaul, PNG | US$ 695/ entry | N.A | N.A | N.A | US$40,000 |
| Tarawa and Kiritimati, Kiribati | N.A | per vessel's GRT /100 x US$5 x Total day | US$100 per service | N.A | US$76,075 |
| Funafuti, Tuvalu | N.A | N.A | N.A | US$7.00 per tonne | US$27,000 |

Source: The country chapters of this book (for Tuvalu) and information kindly provided by A. Hamilton of Trimarine; GRT = gross registered tonnage

# 33 Employment Related to Fisheries

## 33.1 Country information

Information on fisheries-related employment[1] is provided in the country and territory chapters. The objective of this chapter is to understand the importance of participation in fisheries at the national level relative to other occupations and other PICTs. The chapter also examines the distribution of this involvement with respect to gender, age and (where information is available) by sub-sector (tuna, aquaculture, etc.) Employment is an important benefit from fisheries, and it needs to be better quantified so that the sector's contribution can be fully appreciated. In addition, accurate and reliable employment information by fishery could improve fisheries management decisions. Some ideas are therefore presented for improving fisheries-related employment data and information.

Although the fisheries-related employment information in the country and territory chapters is very much a mixed jumble of facts, an attempt is made here to extract the information that best characterises the national fisheries-related employment situation. Table 33-1 presents for each country and territory the survey data that is believed to give the best indication of the relative importance of fisheries employment. This exercise was also carried out in previous Benefish studies (Gillett 2009a and Gillett 2016), and as that information may be useful for comparative purposes, it is repeated in the table below in bold italics. More complete information (including the citations) is given in the country chapters.

[1] In this chapter, employment and participation are used almost synonymously, but there is a tendency to use employment when dealing with wage work and participation for subsistence activities.

Table 33-1: The importance of fisheries-related employment in Pacific Island countries and territories

| Relative importance of fisheries employment (from the present study and *in past Benefish studies*) | |
|---|---|
| Cook Islands | The Cook Islands 2015/16 HIES contains information about fisheries-related employment:<br>• 2.7% of all households receive at least some cash for fishing activities.<br>• 18% of all households participate in fisheries.<br>• 3% of all households sell a portion of their fisheries harvest.<br>The Cook Islands Population Census 2016 found that 24.8% of households fish in the lagoon, 8.0% fish outside the reef, and 15.2% of the households do both.<br>*The 2011 census indicated that 42.4% of households in the Cook Islands participate in fishing, but this is declining. In 2011, 57.6% of households had not engaged in any level of fishing activity, whereas the previous census in 2006 showed 50.6% with no such activity.*<br>*Of the employed population recorded in the 2001 census (5,928 people), 427 (7.2%) indicated they were employed in "agriculture and fishing". Of those people, 183 were on Rarotonga. With respect to subsistence fishing, the employment situation is very different between Rarotonga and the outer islands. A recent SPC survey on Mangaia Island indicated that almost all households (92%) are engaged in fisheries with an average of one to two fishers. A similar SPC survey on Rarotonga shows that less than half of all households (44%) are engaged in fisheries, an average of one fisher per every second household.* |
| Federated States of Micronesia | The report of the FSM Agriculture Census 2016 has information on participation in fisheries:<br>• In 2016, 8,508 households (55% of households in FSM) stated that they had fished in the past 12 months. Fishing was most reported in Chuuk, where 68% of households had fished. Yap reported 61% of households fished, Kosrae reported 46%, and Pohnpei reported the lowest proportion of households at 41%. This rate of fishing is mostly consistent with the 2013/14 HIES for FSM, except for Chuuk, where the rate of fishing reported was significantly higher than the 49% estimated in 2013.<br>• Across FSM, 18% of people aged 15 and over worked on fishing activities. Males made up 84.4% of the fishers, while females made up 15.6%. In Yap, 5.5% of those involved in fishing were females, compared to 16.5% in Chuuk, 20.2% in Pohnpei and 20.4% of those involved in Kosrae. In Yap, more than 60% of males aged between 35 and 54 were engaged in fishing activities.<br>*The 2013/14 HIES has some fisheries employment information:*<br>• *1.8% of total wage and salary income comes from fishing.*<br>• *12.9% of households are involved with subsistence fishing.*<br>• *The net monthly value from subsistence fishing is $18 per household.*<br>• *In 2007 the "number employed persons in fishing" was 1.3% of all employed people in FSM, but it should be noted that the survey was oriented to formal employment with the larger fishing companies. Little national level information available on participation in small-scale fisheries.* |

| Relative importance of fisheries employment (from the present study and *in past Benefish studies*) | |
|---|---|
| Fiji | In recent years, there has been difficulty in applying the results of recent surveys to fisheries employment:<br>• A HIES was carried out in Fiji in 2019/20. Although a summary report is available, a detailed analysis of the data enabling fisheries information to be extracted was not available at the time of writing the present report.<br>• In the 2015/16 Employment and Unemployment Survey, all mentions of fisheries employment are combined with agriculture and forestry. For example, the report states "Agriculture, Forestry and Fisheries – 45,482 money earners accounting for 17.3% of the total".<br>• Similarly, in the Annual Paid Employment Statistics 2019, fisheries employment is aggregated with agriculture and forestry.<br>• An agriculture census was carried out in Fiji in 2020. Although there is considerable fisheries information in the report of the census, most of the results relevant to fisheries are reported for "agricultural households" rather than for all households – distorting the application of the results to fisheries.<br>*A 2008 study estimated the number of (a) subsistence fishers in the country to be about 23,000, (b) full-time artisanal fishers to be about 5,000 and (c) part-time artisanal fishers to be 12,000.*<br>*Combining information in an ADB study in late 2004 and the 2004/05 Fiji employment study, the estimated 9,144 fisheries jobs in the 12 fisheries sub-sectors (e.g. offshore, processing, etc.) represent about 3.8% of the total number of jobs in Fiji (wage, salaried, self-employed). There is little national level information available on participation in subsistence fisheries.* |
| Kiribati | The 2019/20 HIES indicates that nationally, around 44% of all households participate in fisheries activities. The survey also subdivides participation in 10 types of fishing by geographic area, urban/rural, age, sex and disability status.<br>The Kiribati Agriculture and Fisheries Report was prepared from data in the 2020 population and housing census. Similar to the results of the HIES above, this report states that 47% of all Kiribati households participate in fishing. The report breaks down household participation by island, showing a range of 24% on Betio to 90% on South Tabiteuea.<br>In the report "Labour in Kiribati Based on Analysis of the 2019/20 HIES", most of the results that could be relevant to fisheries are lumped with other sectors to form the category of "Skilled agricultural, forestry & fishery workers".<br>*The 2010 census gives the major categories of fisheries jobs broken down by the age and sex of the workers. 3178 total employed in 7 fisheries categories. On examination, the data in the table seem to underestimate the numbers of workers in some types of fisheries jobs.*<br>*The 2005 Kiribati census indicates that 7.1% of "cash workers" were in "agriculture/fishing". The results of earlier census in 2000 had greater detail for fisheries employment: "Fisheries" was the main activity for 1.5% of people. With respect to subsistence fisheries, the results of the fishery-focused surveys by the Fisheries Division are mostly narrow in scope (i.e. one company, one island, one sub-sector of fisheries) and it is difficult to draw national-level conclusions.* |

| Relative importance of fisheries employment (from the present study and *in past Benefish studies*) | |
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| Marshall Islands | In the 2019/20 HIES, most of the fisheries-related employment data is aggregated with other sectors to form the category "Agriculture, forestry and fishery workers". The HIES does state that 15% of all households in the Marshall Islands participate in fisheries activities.<br>Formal employment in the fisheries sector is quite low. The Marshall Islands FY 2021 Statistical Compendium indicates that in 2021 there were 77 jobs in "fishing" and 428 jobs in "fisheries", which includes shore-based fish processing and vessel support services.<br>By far, the largest amount of employment that is related to fisheries in the Marshall Islands is that of the Pan Pacific tuna loining plant. Although the plant did not do any processing in 2021 (presumably due to Covid), employment was substantial in prior years. In 2016, 802 people were employed, and in 2017, 533 people were employed.<br>*In the 2008 employment survey in the country, fishing provided 2.8% of the jobs in the country and 4.7% of the income from jobs. The income level of fishing job holders was only about 65% of the average level.*<br>*The report of the 2011 census states that a total of 3,787 households reported fishing – that is 48.9% of total households in RMI. 64.1% of the households who went fishing claimed it was only for subsistence purposes, while 34.8% claimed that fishing was for both subsistence and income, and 1.1% reported it as a means of income.*<br>*In early 2008 the Economic Policy, Planning and Statistics Office carried out an employment survey that showed that "fishing" accounted for 2.8% of the total number of jobs in the country and 4.7% of the income from jobs. A 2004 survey estimated that 62.2% households on Majuro did at least some fishing once a year. Little national level information is available on participation in subsistence fisheries.* |
| Nauru | The only recent information on fisheries-related employment is from unpublished data from the 2019 HIES which shows the total active population (by nationality), aged 15+ years, working in the formal marine fishing sector. It gives a total of 3,719 of both men and women working in the sector (out of a total population of 11,550 in Nauru).<br>*The 2011 census indicates that the main source of household income for 85% of all households was wages and/or salary, the main income of 7% of households came from own business activities, 4% relied mainly on rent of land, and 2% on the sale of fish, crops or handicrafts. Just over half (51%) of all households in Nauru were engaged in fishing activities. Participation in fishing activities varied greatly among Nauru's 14 districts. The results of the 2012/13 HIES indicate that 26% of the households were engaged in fishing. About 8.94% of the Nauruan Labour force of 3,952 were involved in one form of fishing or another. This equates to about 353 fishers. With regards to full-time fishers, if "full-time" means those who have fishing as their main activity, only 1.26% of the Nauruan labour force seemed to have fishing as the main activity. This equates to about 50 fishers.*<br>*An SPC survey in 2005 indicated that fisheries do not play a significant role in income for households. For 5%, it is their first income and for 17%, their second income. A total of 245 households were surveyed for income and expenditure, with 97% of these found to be engaged in fishing activities.* |

| Relative importance of fisheries employment (from the present study and *in past Benefish studies*) | |
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| Niue | The 2015/16 HIES shows:<br>• Out of a total of 528 households covered, 50% (264 households) were engaged in fishing activities. These fisheries households consisted of 1,016 members, and about 62% were males and 38% females.<br>• An analysis of households by types of fishing activities reveals that 48.86% of the households were engaged in inshore fishing only, 18.18% in offshore fishing only, and 32.95% of the households used both methods of fishing.<br>***The 2009 agriculture census of Niue indicates that most households were engaged in inshore fishing (62%), 31% were involved in both inshore and offshore, and the remaining 7% were involved in offshore fishing only. The main purpose of household fishing activity was for home consumption, accounting for 82% of fishing households, with 16% selling some of their catches, and the remaining 2% of fishing households mainly for sale.***<br>***The 2002 HIES indicates that "fish income" represents 0.9% of all income in Niue for the year, and that 12% of all households have some "fish income". There were 293 boats on the island in 2006 when the population was 1626, or one boat for each 5.5 people.*** |
| Palau | The 2020 census contains some information on employment in fisheries, but unfortunately much of the employment-relevant data are aggregated with jobs from other sectors. For example, in 2020 there were 337 "Skilled Agricultural, Forestry & Fishery Workers". Information in the census that is specific to fisheries-related employment includes the following:<br>• Of the 5,056 households in Palau, 1941 (38%) participate in fishing.<br>• Of the 5,056 households in Palau, 46 (0.9%) participate in aquaculture.<br>The Palau 2021 Statistical Yearbook contains census information that show the evolution of participation in fisheries over two decades:<br>• 2004: 933 people participate in fishing (6.3% [sic] of people over 16 years of age)<br>• 2014: 1,804 people participate in fishing (44% of people over 16 years of age)<br>• 2019: 428 people participate in fishing (45% of people over 16 years of age)<br>***The Fiscal Year 2014 Statistical Appendices has information on employment in Palau obtained through Social Security and tax records. It shows the number of fishing workers: 83; total number of workers in Palau: 10,386; fishing workers as a % of all workers: 0.8%.***<br>***The 2005 census states that (a) of the 13,800 people reporting income in 2004, 305 people (2.2%) reported income from selling fish, and (b) of 14,154 people over 18 years old in 2004, 933 people (6.6%) reported some subsistence fishing activity.*** |

| Relative importance of fisheries employment (from the present study and *in past Benefish studies*) | |
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| Papua New Guinea | There have been few, if any, recent attempts to estimate the employment in small-scale fisheries in the country. The readily available documents on the 2009/10 HIES do not cover fisheries, nor does the final report of PNG's 2011 census.<br>By contrast, there is an abundance of information on employment in PNG's tuna industry. A publication by NFA states: "In 2021 the PNG national domestic fishing and processing industries supported around 12,652 people in direct employment and of this 96% are PNG nationals. Overall, the sector directly employed around 68% PNG females, 28% PNG males and 4% foreigners (both males and females) in 2021."<br>Not much new information is available on participation in small-scale fisheries in the country. The readily available documentation from the latest national census (2011) does not contain the word "fish". The most recent PNG HIES has not been analysed for fishery participation information.<br>*A 2008 FFA study estimated 8,990 jobs associated with large-scale tuna fishing and canning. Considering the "monetary employment" of 774,000 in PNG in 2008, these 8,990 tuna jobs represent about 1.2% of the monetary jobs in the country. A 2005 study estimated that in PNG there are between 2,000 and 4,000 part-time artisanal fishermen. A 2001 study indicated that a large number of people, estimated at somewhere between 250,000 and 500,000, participate in the coastal subsistence fishery. Participation in freshwater fishing is very large. 23% of all rural households in the country are engaged in catching fish (both marine and freshwater fishing).* |
| Samoa | The 440-page report of the Samoa Agriculture Census has a chapter dedicated to fisheries:<br>• Of the 28,516 households in Samoa in 2019, 2,759 households (9.7%) were engaged in fishing activities during the reference period of three months prior to interviews.<br>• The number of households reporting engaging in fishing has been declining significantly, with 10,884 households reporting fishing activities in 1989, 6,699 reporting fishing activities in 1999, and 5,752 reporting fishing activities in 2009. Overall, the number of households engaged in fishing activities decreased by 8,156 (75%) in the last 30 years.<br>• 98 households were engaged in aquaculture in 2019.<br>• 88% of the 2,759 households engaged in fishing activities in Samoa were managed and operated by a single operator.<br>• In the reference week of the census, 5% of the participants in fisheries activities were women.<br>• The age group 25–44 represented 47% of those engaged in fishing.<br>By contrast (and unlike the censuses in other Pacific Island countries), the report of the Samoa Population and Housing Census 2021 has little information on fisheries. There are only three mentions of "fish", and none of the tables have fisheries information.<br>*A 2012 socioeconomic fisheries survey found that fishing is third to agriculture and paid salary in terms of income source. On average, 14% of all households ranked fishing as their first source of household income; the average for coastal communities was higher at 18%. The 2012 labour force survey found that of the working age population, 6.7% were involved with subsistence fishing.*<br>*Formal registered employment in 2007 consisted of 22,150 people, of which 196 (0.9%) were involved in commercial fishing. With respect to small-scale fisheries, a Fisheries Division report in 2007 indicated that although only 7.26% of the population are fishers, 41.7% of households have at least one fisher.* |

| Relative importance of fisheries employment (from the present study and *in past Benefish studies*) | |
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| Solomon Islands | The results of the 2019 Population and Housing Census for Solomon Islands (which should have fisheries employment information) are not yet available.<br>*There were two recent national censuses: 1999 and 2009. The report of the 2009 census shows "changes in paid employment" in the 10-year period between the two surveys:*<br>• *1999: total jobs in fishing were 3,367 (2,935 males and 432 females)*<br>• *2009: total jobs in fishing were 5,736 (5,076 males and 660 females)*<br>• *Changes during the period: 70.4% increase in paid employment in fishing (72.9% increase for males and 52.8% increase for females)*<br>*An ADB study in 2010 stated that the number of subsistence fishers in Solomon Islands can be crudely estimated by looking at the total population—about 570,000 in 2012—and assuming 82% as the rural population. By dividing this by the average number of household members in rural households (5.2 persons), the minimum number of subsistence fishers can be derived. A minimum of 88,000 people are estimated to be engaged in fishing, assuming one household member is a fisher. This, however, is a conservative estimate. If the inputs of women and other adult men are considered in the estimate, the number of subsistence fishers would double to 175,000.*<br>*An IMF study in 2005 indicated a total of 42,297 formal jobs in the country in 2004, of which 5,114 (12.1%) were in fisheries. For small-scale fisheries, an SPC study in 2006 found that 50% of females and 90% of males participate in fishing activities. 83% of households engage in some form of fishing activity.* |
| Tonga | The report of Tonga's 2017 HIES mentions "fish" 147 times. Some of the notable results are:<br>• 63% of households participate in agriculture, 13% in fisheries, 70% in livestock and 39% in handicrafts and home processed foods.<br>• The household participation in fisheries ranges from 6% in urban Tongatapu to 32% in Ha'apai.<br>• One percent of all household income in Tonga is derived from fishing activities.<br>• A total of 5% of all households derive cash income from fishing activities.<br>• Income from the sale of fisheries produce has declined by two thirds in the period 2009–2015.<br>The report of the 2015 Tonga National Agricultural Census (MAFFF 2015) contains a chapter on fisheries. It states that during the 12 months before the agriculture census in April 2015, a total of 2,360 households or 15% of the total households in Tonga engaged in fishing activities. The Niua region had the highest proportion of households engaged in fishing, at 59% (159 households). This was followed by the Vava'u region, in which 35% (835 households) engaged in fishing, then the Ha'apai region at 34% (317 households). In the 'Eua region, only 11% of households engaged in fishing. Although the Tongatapu region had the highest number of households engaged in fishing activities, this only represented 8% of its total households. The Agricultural Census report also has information on relative participation in the sub-sectors: subsistence (54% of all households), semi-subsistence (42%) and commercial (4%).<br>*The 2011 census showed that the main type of work during the last week for 64,597 people was 859 people involved with fishing mainly for sale and 437 people involved with fishing for own consumption. Overall, 2.0% of the population was involved with fishing. Participation in fishing was highest in the 40–44 and 45–49 age groups.*<br>*The 2003 survey of employment indicated that there was a total of 34,561 people employed in Tonga, of which 1,050 (3%) were employed in the category of "fishing". With respect to participation in small-scale fishing, a 2003 Australian-sponsored study estimated the "number of fishers": Tongatapu, 6,470; Ha'apai, 2,053; Vava'u, 4,375, or 12,898 total; 12.8% of the country's population in 2003.* |

| Relative importance of fisheries employment (from the present study and *in past Benefish studies*) | |
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| Tuvalu | The 2021 annual report of the Tuvalu Fisheries Department indicates that the number of households that participate in fishing for subsistence and cash has declined in recent years, suggesting a growing dependence on wages and salaries.<br>The Tuvalu Agriculture and Fisheries Report, which is based on the 2017 census, indicates:<br>• The number of households that sell fish declined by 33.3% between 2012 and 2017.<br>• In 2017 there were 144 males and 15 females whose main activity was fishing. The average age of the males was 37 years and females 30 years.<br>• 111 of the people (77%) whose main activity was fishing reside on Funafuti.<br>• Whilst Funafuti dominates the job opportunities in the public sector, most agriculture, fishing and handicraft production takes place on the outer islands. There is a growing observance that traditional skills are being lost as many of the younger generation migrate to Funafuti in search of employment or are reluctant to engage in the traditional subsistence lifestyle. Slowing the migration of population to Funafuti and improving the quality of life and income earning opportunities for those on the outer islands remains a high priority.<br>*The 2012 census results show that 75.3% of the sampled households participated in some kind of fishing. 9.2% of households in Tuvalu received income from fish sales: 7.2% in Funafuti and 11.0% in the outer islands. Commercial fishing activities were not common. Less than 4% of households were involved in these activities. Only 17% of total households had a boat, 16% owned an outboard motor, while 27% reported owning a canoe. 436 households in Tuvalu (24.7%) were not involved in any kind of fishing activities. Of these households, 301 were from Funafuti and 135 were those living in the outer islands.*<br>*The 2002 Population and Housing Census of Tuvalu indicated that 58% of all people participated in fishing during the week before the census, of which 80% was for only "own/family use", 2% for only sale and 18% for mixed subsistence/commercial.* |

<table>
<tr><th colspan="2">Relative importance of fisheries employment (from the present study and in past Benefish studies)</th></tr>
<tr><td>Vanuatu</td><td>
In the 2020 National Population and Housing Census, most data relevant to fisheries are aggregated into the category "agricultural, forestry and fishery", reducing its utility for fisheries purposes. It does contain the interesting fact that of the 63,365 households in the country, 39.8% are engaged in fishing, with 10.7% in urban areas and 48.6% in rural areas.
Similarly, in the Labour Market Monograph, most data relevant to fisheries are aggregated into the category "agricultural, forestry and fishery".
The report "Well-Being in Vanuatu 2019–2020" is an expanded household income and expenditure survey that collected data critical for informing national economic, social and environmental policy. With respect to fishing, the results indicate:
<ul>
<li>Just under one third (31%) of households in Vanuatu had members actively engaged in fishing, and 29% of households reported consumption of free fish from home production each week.</li>
<li>Fishing is most prevalent in Torba Province, where 75% of households have members engaged in fishing activities.</li>
</ul>
The Vanuatu Socio-Economic Atlas uses information from both the 2009 census and the 2010 HIES.
The Vanuatu 2010 HIES found that more than 75% of the adult population practice at least one form of fishing, whether subsistence or commercial. The survey showed that 2% of urban households and 12% of rural households had income from the sale of fishery products.
There is not much readily available information on the national level about employment in the urban-based commercial fishing/aquaculture/post-harvest activities. A 2007 Agriculture Census indicated (a) 72% of the rural households in Vanuatu possess fishing gear and engaged in fishing activities during the previous 12 months; (b) these fishing households number 15,758; and (c) of those fishing households, 11,577 (73%) fish mainly for home consumption, 4,127 (26%) for home consumption with occasional selling, and 74 (less than 1%) mainly for sale.
</td></tr>
<tr><td>American Samoa</td><td>
Employment in American Samoa directly related to fisheries has two distinct main components: involvement in activities related to fishing and jobs at tuna canneries. The American Samoa Statistical Yearbook indicates that in 2019 the cannery employed 2,533 people, which was 15% of all formal employment in American Samoa. It also states that the "number of fishermen" was 126 in 2018 – which probably refers to the number of people involved in a certain fisheries sub-sector, such as boat-based fishing.
The latest household income and expenditure survey (2015) is not very useful for fisheries-related employment as fisheries employment is aggregated and reported with farming and forestry.
In 2013 the tuna canneries employed 2,108 people. This represents 13.1% of the 16,089 people employed in American Samoa. This employment has declined sharply in recent years. In 2003, 5,036 people were employed at the canneries, about 28.9% of people employed. A 2006 survey showed that 55% of respondents fished for subsistence to some degree, although most people fished only infrequently. Of those who did fish, 72% fished once a week or less (44% of these fished only 1–2 times per month), while 16% reported fishing 10 or more times per month. Approximately 9% of the population surveyed could be considered "frequent subsistence fishermen."
A government survey in 2006 showed 5,894 government workers, 4,757 cannery workers and 6,744 employees in the rest of the private sector. The canneries therefore provided 27% of all employment. There were 153 commercial fishers involved in domestic fishing. Data on involvement in subsistence fishing are not readily available.
</td></tr>
</table>

| **Relative importance of fisheries employment** (from the present study **and *in past Benefish studies***) | |
|---|---|
| French Polynesia | DRM's Statistics Bulletin states there were a total of 1,110 professional lagoon fishers in 2021 (i.e. those that were issued with a "carte professionnelle de pêcheur lagonaire").<br><br>The published report for the 2015 French Polynesia HIES does not contain information useful for estimating the number of people or households involved with fisheries.<br><br>The publication "Bilan de l'emploi en 2020" states that the number of people employed in pearl culture declined 39%, with 590 employed people in 2020 compared to 960 people a year earlier. An older review of labour in French Polynesia by ISPF (2015b) states that the 2014 pearl culture workforce consisted of 1,060 employees. The "Bilan de l'emploi en 2020" also indicates that the employment in fishing and freshwater aquaculture remained constant between 2019 and 2020.<br><br>***A 2015 review of labour in French Polynesia states that the pearl workforce consisted of 1,060 employees in 2014. A 2014 study of the pearl industry states that at the end of December 2013, there were 815 declared wage earners in pearl farming, but as many of the pearl farms are run as family businesses, there are likely to be a large number of non-declared workers.***<br><br>***In 2007, 13 people were involved in non-pearl aquaculture, 7,000 people in pearl culture, 1,800 people in coastal fishing, 1,025 in offshore fishing, and 200 people involved with freshwater fishing, or about 17,500 total. For the relative importance of this involvement: (a) the total population of French Polynesia in 2007 was 259,800, and (b) there were 68,849 "declared" jobs in the economy.*** |
| Guam | There is not much new and relevant information on fisheries-related employment in Guam. The readily available data appear to be limited to:<br><br>• The "Current Employment Report" of Guam's Department of Labor is of limited use in determining the importance of fisheries-related employment. The most detailed disaggregation in that report is the category "agriculture" (which includes fisheries). In December 2021 there were 310 private sector agriculture workers, of which 50 were women.<br>• The U.S. Bureau of Labor Statistics website gives "May 2021 State Occupational Employment and Wage Estimates Guam", which shows that 60 people were employed in "Farming, Fishing, and Forestry Occupations".<br>• The 2020 Guam Statistical Yearbook (BSP 2021) shows 200 people employed in "Farming, Fishing, and Forestry Occupations".<br><br>***A 2008 Bureau of Statistics and Plans report indicated 1,565 full-time fishermen, 60 part-time fishermen and 170 occasional fishermen. All of these jobs were filled by men; zero are reported to be held by women.***<br><br>***A study in 2008 stated that the Guam Fishermen's Cooperative membership includes 164 full-time and part-time fishermen (0.1% of Guam's population), and it processes and markets an estimated 80% of the local commercial catch. With respect to subsistence fishing, a 2007 household survey of 400 local residents showed approximately 40% of local residents fish on a regular basis, which was identified to be more important as a social activity, rather than an income-generating activity.*** |

| Relative importance of fisheries employment (from the present study and *in past Benefish studies*) | |
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| New Caledonia | New Caledonia's annual statistical summary for coastal professional fishers shows:<br>• 75% of the fishers are men and 25% are women.<br>• The median age is 52 years for both men and women.<br>A report on the general state of fisheries in New Caledonia indicates the percentage of households that fish in each area of New Caledonia, with the majority presumably involved in subsistence fishing: greater Noumea (17% of households involved in fishing), northwest (28%), northeast (27%), southeast rural (32%), southwest rural (26%) and Loyalty (27%).<br>A publication of the Direction Des Affaires Maritimes gives the number of people employed on New Caledonia's offshore fleet and shows that 189 people are employed on longline vessels.<br>*A 2015 report gives information on registered commercial fishers in 2010: 613 in coastal fishing and 120 in offshore fishing. A 2014 report from the government fisheries agency updates the information on employment in offshore fishing. It estimates that in 2013, there were 120 onboard crew, 30 people in on-shore vessel management, 60 people in processing and 20 people in fish wholesaling – for a total of 230 people.*<br>*About 1,000 people are employed in commercial fishing/aquaculture in New Caledonia, which represents about 1.2% of the 80,685 economically active people in the territory. With respect to non-commercial fishing, a study in 2000 indicates that of 1,000 people interviewed in the three provinces of New Caledonia, 50% of the respondents fish one to three times per week.* |
| Northern Mariana Islands | Most of the recent general surveys in CNMI have little useful information about fisheries-related employment, such as the Labor Force Survey of 2017, the 2017 CNMI Population Characteristics Report, the 2020 CNMI Census and the 2016 HIES.<br>A recent report by the Western Pacific Regional Fishery Management has some information on fisheries-related employment: fishing in the CNMI is a social activity; only 3% of fishermen reported fishing alone, but 70% reported that their boat is used without them on occasion. In addition, the majority of fishermen (57%) agreed that as a fisherman, they are respected by the greater community.<br>*An NGO-sponsored study in 2011 states that more than 50 professional fishers are estimated to work for formal businesses, while the number of independent and semi-subsistence fishers remains unknown.*<br>*The CNMI Prevailing Wage & Workforce Assessment Study indicates that of the 25,658 people employed in 2014, 425 were employed in "farming fishing and forestry". No further disaggregation is given.*<br>*The 2000 census and the 2005 HIES give data only disaggregated to the level of "people employed in farming, fishing and forestry": 614 people and 894 people, respectively. A survey in 2006 found that 20% of all the people interviewed are active fishermen and go fishing once every week or two.* |
| Pitcairn | The only readily available recent information on fisheries-related employment on Pitcairn is from the Pitcairn Islands Marine Protected Area Management Plan which states: "The local fishery is currently very small-scale with just 12 regular fishers".<br>*In an SPC report there is a statement: "There are no full-time fishers, but there are eight part-time commercial fishers, seven men and one woman". Another SPC report states: "In addition to the eight commercial fishers, there are about 15 non-commercial fishers".*<br>*In 1994 an SPC officer observed that there are eight or nine "hard-core fishers" on the island, with another three or four who also fish fairly regularly. Twelve people equate to about 19% of the island's population.* |

| Relative importance of fisheries employment (from the present study and *in past Benefish studies*) | |
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| Tokelau | The 2015/16 Tokelau HIES indicates that 200 Tokelau households (80% of all households) participate in fisheries. This is an apparent decline from a survey carried out by SPC in 2003 in which 99.3% of all households reported participation in fisheries.<br>In considering the importance of fisheries-related employment in Tokelau, the fact that there is no authorised commercial fishing is significant as it could reduce the pool of potential participants.<br>*The report of the 2011 census only disaggregates employment data to the level of "Labourers, agriculture, and fisheries workers", so it is not possible to determine how many people derive income from fishing. The report does show that males were much more likely than females to help with village fishing (68.4% compared with 6.7% for females). Tokelau residents in the age category of 50–59 years had the highest proportion of people who helped with village fishing (44.8%).*<br>*In 2003 an SPC/FFA mission to Tokelau surveyed 153 households on all three atolls and determined that 152 households (99.3%) were involved in fishing.* |
| Wallis and Futuna | The Report of the Coastal Fisheries Observatory of Wallis and Futuna contains information on fisheries-related employment:<br>• In 2021 there were 28 professional fishers on Wallis and eight on Futuna.<br>• Among the professional fishers cited in the point above, there is one female on Wallis and one on Futuna.<br>• The average age of a professional fisher is 49 years, with a range from 16 to 65.<br>There are several indications that fisheries in Wallis and Futuna have declined in importance in the last few decades. In its annual economic report on Wallis and Futuna for 2021, the Institut d'Emission d'Outre-mer cites the 2019–2021 HIES, which shows that in 2006, 35% of households in the territory were involved in subsistence fishing, but this dropped to 9% in 2019/20. According to the staff of DSA, the total number of fishers (professional and subsistence) was about 2,000 in 2014, but in 2021 it was closer to 200.<br>*A report in 2015 by the government statistics agency estimates that in Wallis and Futuna there are about 40 professional fishers (i.e. full-time commercial fishers). It is also estimated that one in three households does some kind of fishing. Another 2015 report states that the rate of participation in fishing is 39.3% in Futuna and 28.6% in Wallis.*<br>*A fisheries inventory of Wallis and Futuna in 2001 showed that of the 333 fishers identified on Wallis, 26% fish only once per week, 54% two times per week and 20% three or more times per week. Of the 46 fishers on Futuna, only 10 fish often enough to be considered an "artisanal fisher".* |

## Observations on the table

There is a large amount of information presented in the above table. In the section below some comments on the methodology (i.e. issues in measuring fisheries employment) are given, followed by a discussion of the notable features that emerge from the information in the table.

The employment information presented in the country and territory chapters is a heterogeneous collection of various types of data. The reality is that fisheries employment is harder to measure than the other forms of fisheries benefits (GDP, exports, nutrition, etc.) Meaningful summaries of the fisheries-related employment situation at the national level and intercountry comparisons are difficult for a number of reasons:

- The various sources of information on fisheries-related employment range from informal estimates to structured surveys.
- The data are collected in a variety of ways, ranging from surveys confined to the fisheries sector to much broader exercises that cover all economic sectors or the entire population, such as a census or household income and expenditure survey (HIES).
- The studies deal in different ways with the various mixes of paid work, unpaid work and work by the family.
- Definitions for important concepts, such as what constitutes a job or "participation", often vary between the surveys – or are not stated.
- There is inconsistency across countries/territories in the categorisation of employment in fish processing. In some it is placed in the same sector as fishing, while in others it is under manufacturing.
- Some of the studies have produced obviously erroneous results for fisheries-related employment, while for others it is difficult to establish credibility.
- Some of the information has been collected by specific interest groups (e.g. large-scale fishing companies) and could be selective and/or self-serving.

One of the most troublesome issues in measuring fisheries employment concerns the definition and use of the term "household participation in fisheries". The term is the most common metric for fisheries employment in the region. At least 14 PICTs collect and report on household participation in fisheries (number or percentage). In many survey reports (including most in the above table), the term is not defined – and where it is, the definition is often different from that used in neighbouring countries. Currently, it is not even remotely possible to make useful comparisons of the plentiful data on household participation in fisheries given in the above table. Ideally, a single definition of household participation would be used by all PICTs and appear prominently in survey reports where results on household participation in fisheries are given. A definition should be chosen with care; at least one country in the region defines it as "involvement by a household member in fishing activities at least once per year" – which does not seem to sufficiently distinguish a fishing household from a non-fishing household. Given the paucity of other common fishing employment metrics in the region, involvement of a regional agency in defining and promoting "household participation in fisheries" appears well justified.

Another problem area in measuring fisheries employment in the region is aggregating the data on fisheries employment with that of other sectors. In several of the countries/territories, in the more general surveys (e.g. census, HIES) fisheries-related employment data are often reported in a lumped category that is not very useful for fisheries purposes. In Fiji's 2015/16 Employment and Unemployment Survey, all mentions of fisheries employment are combined with agriculture and forestry (e.g. "45,482 jobs in agriculture, fisheries and forestry"). Similarly, in Fiji's Annual Paid Employment Statistics 2019, the number of fisheries jobs is aggregated with agriculture and forestry. Other examples could be cited for the Northern Mariana Islands, Cook Islands, Kiribati, Marshall Islands, Palau, Vanuatu, Guam and Tokelau. This practice of lumping the data makes it difficult to identify fishery employment trends over time and to make comparisons of fishery employment across countries. In addition to making the survey results less useful for the fisheries sector, the practice also creates difficulties for measuring agriculture and forestry employment.

A third troublesome issue in measuring fisheries employment concerns how jobs are counted. A general feature of the information on formal employment related to fisheries of the region is that the definition of the "number of jobs" is vague. In many cases (especially when information is obtained from companies), it is not known whether the "number of jobs" is the total number of people to have worked during a year, the number at a point in time or the number of full-time equivalent (FTE) jobs – or a mixture of the three. This issue makes it difficult to track fisheries-related employment over time and across countries. FTE is the best metric and should be promoted.

Because the commercial fisheries in most PICTs include large firms as well as small or very small businesses (the latter often in isolated areas), the use of general business surveys and surveys based on tax or retirement fund records are inappropriate for gaining accurate information on employment within the fisheries sector. Such surveys are carried out in about half of the countries/territories in the region and typically, responses are mainly received from the larger firms, which are then assumed to portray the entire sector. This problem seems to be worse in fisheries than in other economic sectors.

In assessing fish abundance, it has been said "counting fish is just like counting trees – except you cannot see them and they move around". Similarly, counting fisheries jobs seems to be more difficult than counting jobs in most other sectors. Much of what is to be counted cannot be done directly; some fishers work in isolated places, sometimes far offshore, at night or even underwater. Unlike many other sectors, there is no source of indirect but comprehensive information (e.g. using tax or retirement scheme records). The combination of formal and informal work together with varying degrees of participation in subsistence activities further complicates the situation.

To accurately gauge the relative importance of fisheries in national employment requires a survey which covers all sectors of the economy (e.g. a national census, HIES or labour survey), rather than a fisheries-specific study. The sampling strategy for such a national level study (i.e. national census, HIES, labour survey) must not be biased against particular sectors, which in the case of fisheries would require at least some dialogue between the formulators of the survey and those with technical expertise in fisheries.

It is clear that reliance on government statistics offices to know what fisheries-related employment information to collect and how to collect it simply does not work. Considerable knowledge of the sector is required to collect meaningful information. Government fisheries officials and fishing industry participants have an important role to play in working with statistics offices in defining terms/categories, formulating survey strategies and scrutinising survey results.

One of the major features in fisheries-related employment in the region is its decline in importance in recent years. Examples of this from the country chapters are:

- The report of the 2015/16 Tokelau HIES indicates that 200 Tokelau households (80% of all households) participate in fisheries. This is an apparent decline from a survey carried out by the Pacific Community (SPC) in 2003 in which 99.3% of all households reported participation in fisheries.
- In the Cook Islands, the 2011 census indicates that 42.4% of households participate in fishing, while in the 2015/16 HIES it is reported that 18% of all households participate in fisheries.
- In Samoa, the number of households that reported engaging in fishing from various surveys has been declining significantly, with 10,884 households reporting fishing activities in 1989, 6,699 reporting fishing activities in 1999, and 5,752 reporting fishing activities in 2009. Overall, the number of households engaged in fishing activities decreased by 8,156 (75%) in the last 30 years.
- There are several indications that fisheries in Wallis and Futuna have declined in importance in the last few decades. In its annual economic report on Wallis and Futuna for 2021, the Institut d'Émission d'Outre-mer cites the 2019–2021 HIES, which shows that in 2006, 35% of households in the territory were involved in subsistence fishing, but this dropped to 9% in 2019/20. According to the staff of the government

fisheries agency, the total number of fishers (professional and subsistence) was about 2,000 in 2014, but in 2021 it was closer to 200.

- In Tonga, the income from the sale of fisheries produce has declined by two thirds in the period 2009–2015.
- The Tuvalu Agriculture and Fisheries Report, which is based on the 2017 census, indicates that the number of households that sell fish declined by 33.3% between 2012 and 2017.

Some comments can be made about the decline. The surveys quantify the decline in participation in fisheries but do not explain or speculate on the cause of the decline. Most of the countries/territories that are experiencing a major decline are the smaller and relatively developed places, whereas in the larger countries (e.g. Solomon Islands), participation in fisheries seems to be expanding. Most of the points made above deal with coastal fisheries (especially coastal subsistence), whereas employment in the offshore fisheries of many countries is expanding. In the tuna-related employment section below, it is stated: "Total employment related to tuna fisheries in FFA member countries for 2021 was estimated at 27,442, up 42% from 2015 and 14% from the previous year".

Other major features in fisheries-related employment in the region are:

- Tuna canning and loining factories are labour intensive – and most of the fisheries employment is related to these operations, which are located in PNG, Solomons Islands, Marshall Islands[2], Fiji and American Samoa.
- In many cases, very different types of surveys produce similar results on participation in fisheries. As an example, the 2019/20 HIES in Kiribati indicated that nationally around 44% of all households participate in fisheries activities. The Kiribati Agriculture and Fisheries Report, which was from data in the 2020 population and housing census, found that 47% of all Kiribati households participate in fishing.
- Some of the survey results given in the above table seem dubious. As an example, the Nauru 2019 HIES shows the active population working in the formal marine fishing sector. It gives a total of 3,719 men and women working in the sector out of a total population in Nauru of 11,550 (does a third of the country's population have *formal* employment in fisheries?)
- Estimation of employment from tax or social security records disadvantages the fisheries sector. As an example, the Marshall Islands Fiscal Year 2021 Statistical Appendices show 92 people employed in "fishing" (estimated using social security records), but in a section below the Forum Fisheries Agency (FFA) estimated (by interviewing companies) that 1,058 people are employed in just the tuna industry.

[2] The Pan Pacific Foods operation in Majuro did not process any fish in 2021.

## 33.2 Participation of women in fisheries

In the country chapters of this book, the readily available information on the participation of women in fisheries in the region is presented. It includes the results from fisheries-oriented studies, as well as more broad-based work such as HIESs and national population censuses.

SPC has recently carried out a number of national gender assessments of the fisheries sector which highlight gender roles – and these are given in the country chapters of this book. As an example, Box 33-1 summarises the gender roles in fisheries and aquaculture from one of the SPC assessments.

**Box 33-1:** Gender roles in fisheries and aquaculture in Tonga

In Tonga, as in other Pacific countries, off-shore fishing is almost exclusively dominated by men, although women may work in the shore-based components of commercial operations. Women are engaged in subsistence fishing and gleaning and the Tonga Fisheries Sector Plan notes that, in some areas, women's subsistence gleaning activities account for over 75% of invertebrate harvests. Women also do small-scale marketing of fish and shellfish in the main markets and engage in some aquaculture activities, such as pearl farming. There is scope to involve women in all of these areas; proactive engagement, use of gender indicators in monitoring and evaluation, and documentation of lessons could highlight good practice and facilitate replication in multiple areas. Research done in 2002 found that about half the village women surveyed in Ha'apai were engaged in fishing for finfish. In Vava'u, information from the same study showed that between 6% and 21% of women fished. Women's fishing techniques varied in the areas surveyed and included net casting, spear fishing and using handlines. Numbers for gleaning were higher, ranging from 72% to 92%. Men also engaged in these activities but at different times of the day and for different durations. Women preferred fishing in the day, while men did night fishing. Women also spent slightly less time gleaning than did men. Men used different gear – handlines as well as all types of nets. Men also trolled and did deep-bottom fishing to harvest finfish, whereas women were not reported to use those techniques.

Source: SPC (2019)

One of the most geographically comprehensive surveys of the gender aspect of participation in fisheries in the region was that carried out by SPC's Pacific Regional Oceanic and Coastal Fisheries (PROCFish) project. In that multi-disciplinary, region-wide fisheries work, from four to six sites were surveyed across 17 countries/territories or island groups. The results included participation in village-level fishing by gender. This participation is shown for all types of fishing activities combined in Figure 33-1.

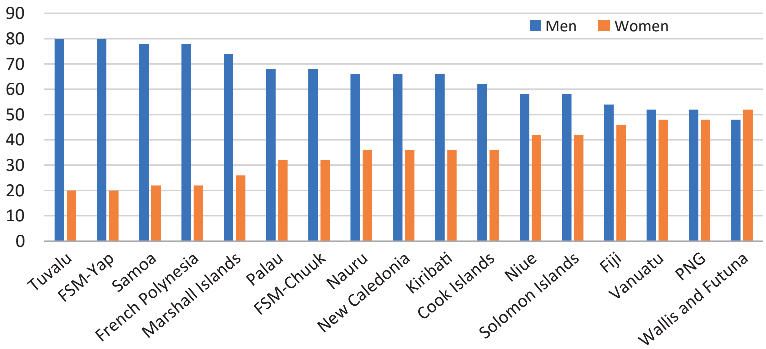



**Figure 33-1:** Participation of men and women in fishing (%). Source: SPC (2013)

Employment of women at tuna canning and loining operations in the region is especially important. Two decades ago, an FFA study showed that the five tuna canneries operating then employed 5% of all formally employed women in the entire region. In a study of gender and tuna industries in the Pacific Islands (Barclay 2021), the importance of cannery employment for women in the Solomon Islands is highlighted:

> Women make up two thirds of the SolTuna cannery workforce, with most of these being the women cleaning and preparing fish loins for canning. As is usual in seafood processing globally, these processing line workers are almost all women. Since the cannery first started in Noro in the early 1990s, it has been an important opportunity for rural women with low levels of schooling to enter the formal economy. The importance of these opportunities is heightened by the fact that rural employment sits at only 13% on average, with rural women's employment rates much lower than this.

Since the early 1980s, the theme of many of the studies of women in fisheries in the region has revolved around the concept that more information on the roles of women is needed so that their contribution can be fully appreciated. This is embodied in a statement in the recent article "Why they must be counted: Significant contributions of Fijian women fishers to food security and livelihoods" (Thomas et al. 2021): "Women play crucial roles in these fisheries, yet their contributions are largely *invisible*, often *ignored* and *unrecognized*". After a substantial amount of this type of work over several decades, the role of women in fisheries and associated problem areas are now much better understood. Currently, there is justification for at least some emphasis on a different aspect of women in fisheries in the region: promoting the movement of women into senior positions in government fishery agencies to accelerate progress in addressing those gender-related problem areas that can be mitigated by interventions of fisheries agencies.

Having women in such important roles could contribute to the important issues of problem recognition and promotion of more gender sensitive policies in the fisheries sector – as well as the general benefit of having more women in fisheries management. What is the Benefish aspect of this situation? Following the lead of FFA successfully tracking the progress in the goal of increasing Pacific Islander employment in the tuna industry, there is a need for regularly monitoring and quantifying the movement of women into senior roles in government fishery agencies.

## 33.3 Age and fisheries-related employment

Since the 2016 Benefish study, there has not been much new information on age and fisheries-related employment. Recent study findings appear to be limited to four mentions in the country chapters:

- In Tuvalu, there were 144 males and 15 females whose main activity was fishing. The average age of the males was 37 years and females 30 years.
- New Caledonia's annual statistical summary for coastal professional fishers shows the median age is 52 years for both men and women.
- In Wallis and Futuna, the average age of a professional fisher is 49 years, with a range from 16 to 65.
- In Tonga, participation in fishing was highest in the 40–44 and 45–49 age groups.

An older study in New Caledonia in 2013 points out an important issue related to the age of fishers: "despite the relatively young population of New Caledonia, fishers are getting older, which could be an indication of the non-attractiveness of the sector".

A study in Kiribati ten years ago resulted in a very good portrayal of the age aspect fisheries employment in the region (Table 33-2).

Table 33-2: Kiribati fisheries-related employment by age (number of people)

| Job category | Age | | | | |
|---|---|---|---|---|---|
| | All | 15–24 | 25–34 | 35–49 | 50+ |
| Fishing guides | 14 | 3 | 4 | 4 | 3 |
| Seaweed farmers | 126 | 38 | 27 | 44 | 17 |
| Coastal fisherman | 2,730 | 751 | 749 | 845 | 385 |
| Other fisheries workers ("Kereboki" etc.) | 152 | 37 | 49 | 43 | 23 |
| Deepsea fisherman | 122 | 30 | 34 | 45 | 13 |
| Other fisheries workers (other than above) | 7 | 2 | 5 | 0 | 0 |
| Fishery assistants | 27 | 5 | 9 | 11 | 2 |
| **Total** | **3,178** | **866** | **877** | **992** | **443** |

Source: Kiribati 2010 Census of Population and Housing (NSO 2012b)

## 33.4 Employment in some fisheries sub-sectors

### Employment related to offshore fishing

Of all the fishery sub-sectors in the region, the offshore fisheries and associated land-based activities (together, the "tuna industry") have the best employment data. FFA employs data collectors at the national level and has a team of economists at its headquarters in Honiara to analyse and publish the data. That employment data and other economic indicators are reported periodically in two series of documents: the Tuna Fishery Report Card and the Economic and Development Indicators and Statistics: Tuna Fisheries of the Western and Central Pacific Ocean. Table 33-3 and Figures 33-2 and 33-3 show the most recent number of jobs and some historical information for each of the FFA member countries from those two documents. Those reports state that the number of jobs given "includes harvest, processing and ancillary services sectors, observers and government employees (artisanal sector not included)."

**Table 33-3:** The number of tuna industry jobs in each FFA member country

| | 2010 | 2015 | 2020 [3] |
|---|---|---|---|
| Cook Islands | 26 | 65 | 88 |
| Fiji | 991 | 3,658 | 3,313 |
| FSM | 373 | 245 | 1,166 |
| Kiribati | 256 | 980 | 961 |
| Marshall Islands | 1,259 | 1,424 | 1,058 |
| Nauru | 5 | 85 | 346 |
| Niue | 0 | 4 | 4 |
| Palau | 42 | 46 | 43 |
| PNG | 7,086 | 9,549 | 13,151 |
| Samoa | 414 | 327 | 339 |
| Solomon Islands | 1,004 | 2,364 | 3,425 |
| Tokelau | 8 | 6 | 7 |
| Tonga | 66 | 142 | 296 |
| Tuvalu | 242 | 185 | 118 |
| Vanuatu | 0 | 0 | 864 |
| **Total** | **11,772** | **19,080** | **25,180** |

Source: 2020 Economic Indicators Report (Ruaia et al. 2022), Tuna Fishery Report Card 2022 (FFA 2022a)

[3] The 2020 data in the table consist of the average annual outcomes over the period 2019–2021.

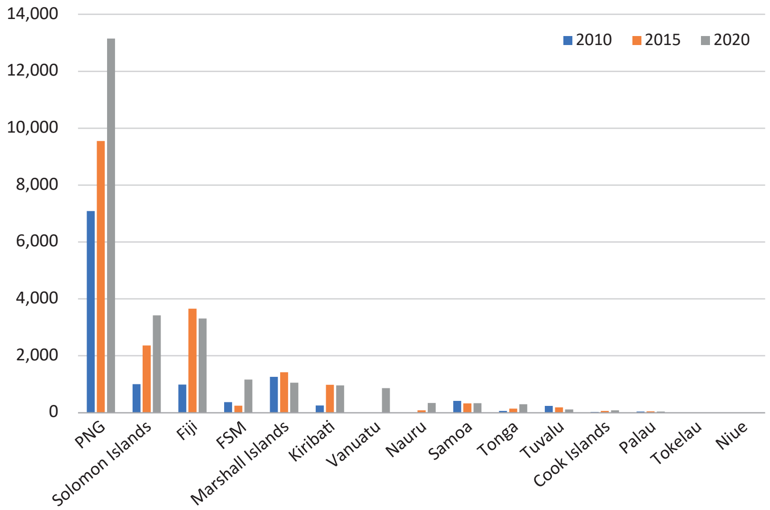



**Figure 33-2:** The change in number of tuna industry jobs by country, 2010–2020

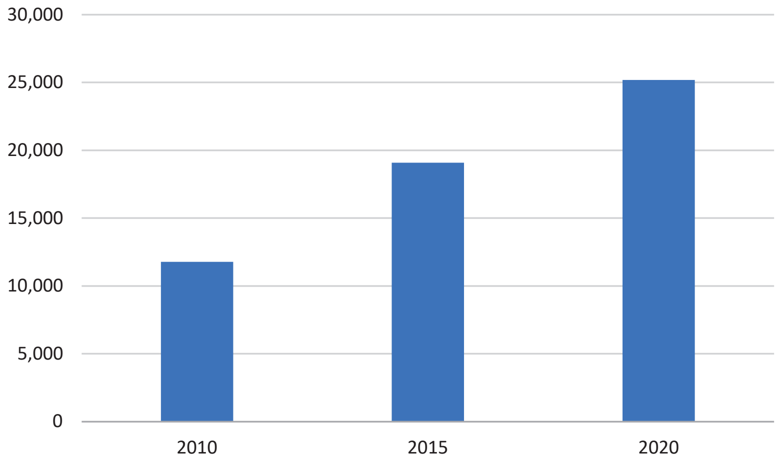



**Figure 33-3:** The change in number of tuna industry jobs in the region, 2010–2020

Three comments can be made on the measuring of tuna industry jobs:

- Even allowing for the margins of error/misrepresentation mentioned above, the increase in tuna industry jobs between 2010 and 2020 is substantial: a rise from 11,772 to 25,180.
- As mentioned in a section above, a general feature of the information on formal employment related to fisheries of the region is that the definition of the "number of jobs" is vague. For comparisons over time, across countries and across industries, the number of jobs needs to be expressed as full-time equivalent (FTE) jobs.
- As tuna companies may have some incentive to overstate the number of jobs, there is need for a company-independent mechanism to verify the number of jobs, such as tax records or provident fund information.

Some comments on the tuna industry jobs and their change over time are given in the 2022 Tuna Fishery Report Card (Box 33-2).

**Box 33-2:** Tuna industry jobs

Total employment related to tuna fisheries in FFA member countries for 2021 was estimated at 27,442, up 42% from 2015 and 14% from the previous year. Since 2010, employment has increased steadily with the onshore processing sector contribution most to this increase and accounting for around 60–70% of all employment in the tuna fisheries. Around 17,400 people were employed in the onshore processing sector in 2021, a rise of 6% from the previous year. After an 11% decrease in employment in 2020 as a result of COVID-19 mitigation measures' effects on domestic longline operations and related supply chains, employment in the harvest sector increased to 7,826 in 2021. Observers and the public sector contribute around 3% and 5% of total employment respectively. About 73% of all tuna processed or handled onshore 2021 occurred in PNG, which employs the majority of persons working in the sector. In the same year, around 13% of processing employment was in the Solomon Islands and 10% in Fiji. There is a need to ensure decent working conditions for those employed in the fisheries sectors. In a ground-breaking step, regional minimum terms and conditions of employment for vessel crews were agreed by FFC Ministers in 2019, with FFA Members to make best endeavours to give domestic effect to the new conditions by 1 January 2020.

Source: 2022 Tuna Fishery Report Card (FFA 2022a)

Box 33-2 above states that the onshore processing sector accounts for around 60–70% of all employment in the tuna fisheries. At the country level, tuna processing (especially canning and loining) is extremely important in five PICTs. From the country chapters:

- Marshall Islands: By far, the largest amount of employment related to fisheries in the country is that of the Pan Pacific tuna loining plant. Although the plant did not do any processing in 2021 (presumably due to Covid), employment was substantial in prior years. There were 802 people employed in 2016, and 533 people were employed in 2017.

- Solomon Islands: Sol Tuna is a Solomon Islands-based tuna company operating a large-scale tuna processing plant in Noro, Western Province. Sol Tuna employs over 1,500 workers, the majority of whom are women, at its production facilities.
- PNG: About 73% of all tuna processed or handled onshore in the region in 2021 occurred in PNG. Despite the Covid pandemic, production from the processing plants (largely fed by the PNG domestic fleet) has consistently increased by 10% year on year from 2019–2021.
- American Samoa: The American Samoa Statistical Yearbook indicates that in 2019 the cannery employed 2,533 people, which was 15% of all formal employment in American Samoa.
- Fiji: The number of jobs at the PAFCO cannery in Levuka has been about 800–1,000 over the last decade.

## Employment related to other fishery sub-sectors

Compared to the employment data on the tuna fisheries, the readily available information on employment in the other fishery sub-sectors is not very good.

For aquaculture, a previous SPC aquaculture officer kept an informal record of aquaculture jobs based on information obtained in his travels. Some information on aquaculture employment is available in a few countries based on HIESs and censuses. The Cook Islands Population Census 2016 (2018b) gives the number of households involved in aquaculture (Table 33-4).

**Table 33-4:** Number of households engaged in aquaculture

| | Non-pearl aquaculture | Pearl farming |
|---|---|---|
| Rarotonga | 12 | 12 |
| Southern Islands | 15 | 3 |
| Northern Islands | 5 | 27 |
| Cook Islands | 32 | 42 |
| % participation (out of 4,435 total households) | 0.7% | 0.9% |

Source: modified from CISO (2018b)

Other information on aquaculture employment from the country chapters of this book:

- Palau: According to the 2020 census, of the 5,056 households in Palau, 46 (0.9%) participate in aquaculture.

- Samoa: According to the 2019 agriculture census, 98 households in Samoa were engaged in aquaculture, with 25 cultivating tilapia.
- French Polynesia. According to the publication "Bilan de l'emploi en 2020", the number of people employed in pearl culture declined 39% in 2020, with 590 employed in 2020 compared to 960 people a year earlier.

The recent and readily available employment information in other fishery sub-sectors in the region consists of:

- In late 2019 there were 34 companies exporting aquarium products in the region. Most of them were quite small, especially in Kiribati (which had the most, 13). About 257 people (full-time equivalent) were directly employed by these 34 companies. The three countries employing the most people were Kiribati (90 people), Fiji (60) and Tonga (55) (Gillett et al. 2020).
- Approximately 1,277 staff are employed in PICT government fishery agencies, not counting observers and temporary project staff (Govan 2015).
- Much older studies (some dating from the 1990s) have attempted to estimate employment of Pacific Islanders in trochus processing, on foreign fishing vessels and in small-scale fisheries.

Given the amount of effort that regional organisations have focused on discrete fishery sub-sectors across the region, it is surprising that more work has not been done on estimating the associated employment – especially considering that unemployment is arguably one of the most serious long-term problems of the region. There appear to be no readily available data on total regional employment in activities such as the domestic fish marketing, sea cucumber diving/processing, commercial sportfishing or the use of fish aggregating devices (FADs).

With respect to estimating regional employment in fishery sub-sectors, two points should be noted:

- Any estimate, however crude, may have considerable value, if only to encourage refinement of the estimate. In this regard, SPC's past efforts to estimate aquaculture employment in the region are commendable.
- Some degree of standardisation in terminology and units of measurement is important. As mentioned in other sections of this book, it is not very meaningful to compare the number of "full-time equivalent jobs" in one study to the number of people having "full-time or partial employment" in another study.

## 33.5 Employment information and fisheries management

It is easy to see that the available information on fisheries participation and the associated benefits is scattered and inconsistent. Attempts at improving the situation must address these difficulties identified above. With the possible exception of employment related to tuna, little recent information is available quantifying employment by most fisheries sub-sectors in any of the countries within the region.

It is important to recognise why information on fisheries participation should be collected. The present study is focused on determining benefits from the fisheries sector; employment is an important benefit from fisheries, and it needs to be quantified so that the sector's contribution can be fully appreciated. On a different level, information on fisheries-related employment is critically important in fisheries management. Fisheries management involves trade-offs, and it is important to determine how many people will be affected by decisions, both positively and negatively.

As an example, there has been a debate in Fiji over at least two decades involving the trochus trade. The fisheries management issue is whether to ban the export of unprocessed trochus (and encourage processing and associated employment in Suva), or whether to allow unprocessed exports (which results in a higher price to rural fishers). The number of people working at the trochus processing plants is known, but no estimates have ever been made of the numbers of trochus collectors.

Similar debates over the number of people affected by fisheries management decisions have taken place in several other fisheries of the region, including beche-de-mer (Solomon Islands), spearfishing (Fiji), night scuba diving (American Samoa), giant clams (Tonga) and export of reef fish (Palau).

The message is that the availability of employment information by fishery could improve fisheries management decisions. Other disaggregations of employment data that would be useful to fisheries management are by gender, by urban/rural resident and by local/expatriate. The use of Asian crew versus local crew on locally based tuna vessels is a critical fisheries management issue in several countries of the region, which would be helped by accurate estimates of local crew employment.

# 34 Fish Consumption

## 34.1 Per capita fish consumption

The readily available information on the consumption of fish and other fishery products is given in the country and territory chapters. Table 34-1 below is a compilation of the ranges in estimates of fish[1] consumption rates for each country and territory from various sources, as listed in the chapters and in previous Benefish studies (Gillett 2016; Gillett 2009a; Gillett and Lightfoot 2001). Information in the "range of estimates" column comes from fisheries surveys, dietary surveys and household income and expenditure survey (HIES) work. Figure 34-1 graphs the information from Table 34-1.

This exercise was also carried out in the previous Benefish studies, and as that information may be useful for comparative purposes, it is repeated in the table below in bold italics. More complete information (including the citations) is given for each country in the country chapters. Where there have been new per capita consumption estimates from the present study that have expanded the range of estimates given in the table below, they are shown underlined in the "Range of Estimates" column.

**Table 34-1:** Estimates of annual per capita fishery product consumption

| | Range of estimates from many surveys (kg per person/year) | Other information on fishery product consumption (this study; Gillett 2016) |
|---|---|---|
| Cook Islands | 34.9–71.0 | The Cook Islands HIES indicates that 5.5% of household expenditure on food is for "fish and seafood". This is small compared to the 27.0% expenditure on "meat".<br>Most fish consumption studies are focused on Rarotonga. Some studies appear to have used food value, while most have used whole fish equivalent. |
| Federated States of Micronesia | 69.3–142.0 | The only new readily available information is from University of Guam researchers who showed annual commercial landings in Chuuk were estimated to be 265 t, translating to a mean annual consumption of just 4.3 kg of commercially caught reef fish per person, suggesting the obvious importance of subsistence fishing to Chuuk's fish consumption.<br>Gillett (2016) estimated the annual per capita consumption of domestic coastal fishery products to be 49.9 kg. To this must be added consumption of offshore fishery products and imports. |

[1] Fish is used to mean finfish and edible invertebrates.

| | Range of estimates from many surveys (kg per person/year) | Other information on fishery product consumption (this study; Gillett 2016) |
|---|---|---|
| Fiji | 20.7–62.0 | If it is assumed that most, if not all, of the domestic longline sales are to consumers in the Suva area, the amount of longline fish equates to 17.8 kg per year for the 185,000 consumers in the greater Suva area in 2017.<br>The annual supply of fish to the Suva area by the locally based offshore fleet is about 11.8 kg/person. |
| Kiribati | 62.2–207.0 | The 2019/20 HIES shows that the total per capita consumption of three categories of fish (pelagic, reef, fish not further specified) to be 49.6 kg/year of "edible quantity", plus 75.9 kg/year "quantity as purchased".<br>Rejected fish from purse seine transshipment in 2014 was about 7.5 kg per resident of South Tarawa and Betio. |
| Marshall Islands | 38.9–65.7 | The Marshall Islands 2019/20 HIES states that an average of 180 g/capita/day of fish and fish products is consumed. This equates to an annual per capita consumption of 65.7 kg.<br>If the coastal fisheries production in 2014 of 4,500 t (estimated by the 2016 Benefish study) is divided by the population, the result is 82.5 kg/person/year – but this does not consider reef fish exports, non-residents in Marshall Islands that consume local fish, imports, or domestic consumption of the leakage from tuna transshipment operations. |
| Nauru | 46.7–63.9 | The present study estimates the production from coastal fisheries (commercial and subsistence) and aquaculture in Nauru in 2021 to be 240.1 t. With a population of 11,832 in Nauru in 2021, that equates to annual per capita fish consumption of 20.3 kg; however, this does not include imports of fish.<br>The 46.7 kg in the column to the left was from the late 1990s. The fish consumption rate is likely to have changed remarkably since then. |
| Niue | 49.0–118.9 | In the present survey, production from coastal commercial and subsistence fisheries is estimated to have been 169 t in 2021. Considering the population of Niue was 1,720 in 2021, this equates to 98 kg per capita per year, without considering informal fish exports or canned fish imports.<br>Two types of estimates from the SPC/PROCFish survey results suggest very different consumption rates: 112 kg vs 51 kg. |
| Palau | 33.4–135.0 | Wabnitz et al. (2018) state that reef fish consumption contributes considerably to future projected declines in marine resources. For Palau to achieve its goals of boosting revenues while sustainably stewarding marine resources, it will be necessary to transfer some level of consumption from reef fish on to tuna and other pelagics.<br>In 2014 offshore fishing (longline and pole-and-line) contributed 10.3 kg/person/year. The estimation of fish consumption is complicated by a large tourist population. |

| | Range of estimates from many surveys (kg per person/year) | Other information on fishery product consumption (this study; Gillett 2016) |
|---|---|---|
| Papua New Guinea | 13.0–24.9 | NFA (2015) states that for the coastal and island areas of PNG, estimates of annual fish consumption per capita range from 4.8 kg to 24.9 kg. The FFA Tuna Report Card indicates the importance of canned tuna to local markets in some members, with annual consumption in PNG of 3,300 t.<br>The Bell et al. (2009b) estimate was from a non-HIES survey. |
| Samoa | 46.3–129.5 | The 2018 HIES shows about 164 grams of fish is consumed per day, of which half is in the form of canned fish (59.9 kg/person/year).<br>The Tiitii et al. survey (2014) gave the highest consumption by far: finfish (46.15 kg/year), invertebrates (54.74 kg/year) and canned fish (28.61 kg/year). |
| Solomon Islands | 32.2–45.5 | The domestic use of various types of fish from offshore industrial vessels is important in the Solomon Islands – and is probably greater than for any other Pacific Island country. Residents of Honiara consume 4.7 kg of salt fish per year. In 2018, 855 t of tuna and 164 t of bycatch was sold domestically by National Fisheries Developments.<br>The relatively new "salt fish" trade in Honiara consists of selling damaged fish from tuna transshipment and equates to residents of Honiara consuming 6.7 kg of salt fish per year. |
| Tonga | 20.3–35.0 | In some years, up to 3,500 t of tuna from the local longline fleet is available in Tonga. If 1,000 t of tuna is sold annually in Tongatapu, that equates to about 13 kg per year for each of the 75,000 residents of Tongatapu.<br>The 2014 tuna catch of 243 t by Tonga-based offshore fishing vessels was accompanied by 228 t of by-catch. If it is assumed that 20% of the tuna catch and half of the bycatch was not exported, this equates to 1.6 kg/person/year for all of Tonga. |
| Tuvalu | 72.0–146.0 | The 2015/16 HIES indicates a decline in fish consumption over the past decade.<br>A Fisheries Department report summarised the results of many studies on the level of consumption of marine resources in Tuvalu, showing consumption rates vary from island to island but are in the range of 100 to 200 kg per year. |

| | Range of estimates from many surveys (kg per person/year) | Other information on fishery product consumption (this study; Gillett 2016) |
|---|---|---|
| Vanuatu | 13–37 | Albert et al. (2018) describe a study that used fisheries data collected by community monitors from 11 sites across four provinces in Vanuatu between February 2017 and July 2018. The report states that estimated annual fresh fish consumption ranged from 13 to 37 kg per person (on average 23 kg per person).<br>The Marine and Coastal Biodiversity in Pacific Island Countries (MACBIO) project examined a number of studies on fish consumption in Vanuatu. The report of the study states that the annual level of consumption of fresh seafood in Vanuatu varies between 16 and 26 kilograms per person. |
| American Samoa | 15.5 | Staff of the Statistics Division of the Department of Commerce and of the Department of Marine and Wildlife Resources in American Samoa indicate that they are not aware of any recent surveys covering fish consumption in the territory.<br>It is difficult to determine the actual annual per capita consumption of fish in American Samoa because of (1) the fish from the locally based offshore fleet that is consumed domestically, (2) the "leakage" of fish from foreign-based offshore fishing, (3) imports of fishery products, and (4) the products of the American Samoa canneries that are domestically consumed. |
| French Polynesia | 46.5–70.3 | Alvea Consulting (2021) is a study of many aspects of the marketing and consumption of fish in Tahiti. The report states that 789 t of lagoon fish are consumed by the households of Tahiti. This equates to an average of 73 kg (whole fish equivalent) per household and 20 kg per individual.<br>In a 2009 study, various studies giving fish consumption in French Polynesia were examined to give rates for the various island groups: rural Tahiti (19.3 kg/person/year), Society Islands except Tahiti (43.7), Austral Islands (43.7), Marquesas (21.9) and Tuamotu/Gambier (150). |
| Guam | 20.4–27.2 | The only new and readily available information on fish consumption on Guam are the advisories issued by the Guam Department of Public Health and Social Services to avoid consuming fish in certain areas.<br>The Development Plan for Aquaculture on Guam indicates that the total annual seafood supply obtained is about 8 million pounds (3,624 t) and the per capita consumption is about 45 pounds (20.4 kg) per year. |

| | Range of estimates from many surveys (kg per person/year) | Other information on fishery product consumption (this study; Gillett 2016) |
|---|---|---|
| New Caledonia | 21.6–41.2 | A report by the Coastal Fisheries Observatory (OPC 2022) cites a 2016 study that indicated that the people of New Caledonia consume 8,700 t of fish from the lagoon each year. This equates to 31.8 kg of lagoon fish annually for each of the 273,674 residents of New Caledonia. If this 31.8 kg is added to the per capita consumption of pelagic fish (6.7 kg) and the per capita consumption of shrimp (2.7 kg), the total is 41.2 kg per capita per year.<br>The production from offshore fisheries equates to about 26.2 kg/year for each of the 100,000 residents of Noumea. |
| Northern Mariana Islands | 23.0 | A recent survey showed that nearly half (45%) of the survey respondents reported eating "somewhat less fish" than they did a decade ago, although the majority still ate fish between one and three times a week. Most of the fish consumed come from the U.S. mainland (41%), with other important sources being Saipan's coral reefs (31%), deepwater or pelagic fish caught off of Saipan (23%), or fish imported from other Pacific Islands (e.g. Chuuk; 10%).<br>Estimating fish consumption is complicated by large amounts of canned and non-canned seafood imports, the presence of a large tourist population, and a subsistence fishery that was not covered by the 2005 HIES nor explicitly by current fishery monitoring programmes. |
| Pitcairn | 153 | Only 49 residents |
| Tokelau | 119.4 | According to the Tokelau National Statistician, other than the HIES, there has not been recent work on fish consumption in Tokelau. The 2016 Tokelau HIES shows that "'Chicken (quarter leg)" is the top item consumed by households. However, that survey also states that "Fish (not specified)" is the top home-produced item consumed by households.<br>There is a substantial amount of imported protein food products. |
| Wallis and Futuna | 27–74.6 | Futuna has a higher per capita fishery product consumption rate than Wallis, 34.6 kg vs 19.4 kg, respectively. This equates to a consumption rate for the two islands of 27 kg per resident per year, a considerable drop from 75 kg per resident per year in 2006.<br>The 2016 Benefish study estimated the 2014 annual consumption of domestic fishery products to be 68.7 kg of fish per capita, but this does not consider imports. |

Note: Outlying estimates have been eliminated. Source: The present study and Gillett (2016)

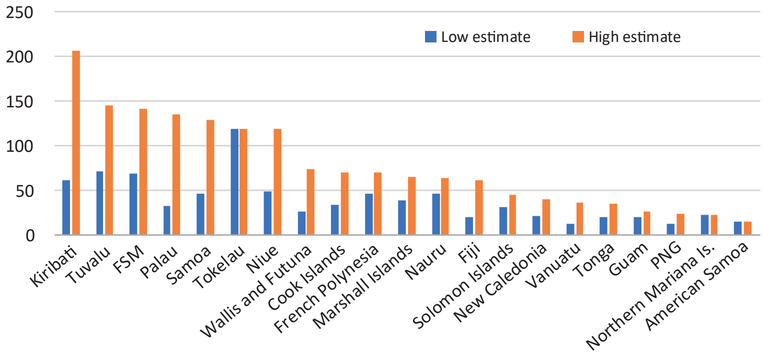



**Figure 34-1:** Ranges in estimates of annual per capita fish consumption (kg/person/year)

Some observations on the above table and graph are as follows:

- There have been few new fish consumption studies (shown underlined in the "Range of Estimates" column in the above table) since that given in the 2016 Benefish study.
- The range in per capita consumption in the "Range of Estimates" column in the above table can come from a change in the national per capita fish consumption rate over time or from the methodology used to make the estimate (or both).
- In general, the countries that are made up mostly of atolls (Kiribati, Tuvalu and FSM) have the highest fish consumption rates.
- The countries that have the lowest fish consumption rates are those that either have large inland populations (PNG and Vanuatu) or are relatively affluent.
- Several of the countries that have moderately high fish consumption (FSM, Palau and Samoa) had locally based longline fleets during the period of the consumption studies.
- The notes in the table suggest a growing consumption of fish from industrial tuna fishing operations.
- The countries with very high consumption rates also have very large ranges in the rates.

The last point deserves some additional attention as it may provide some insight into the accuracy of fish consumption estimates. It may also be worthwhile to explore the issue as the high end of the ranges would make some Pacific Island countries among the highest per capita consumers of fish in the world. Box 34-1 tracks the origins of the high and low ends of the range of fish consumption estimates for Kiribati. The analysis shows that both estimates are quite dated. It also suggests that the upper end of the range is likely to be more credible than the lower end.

**Box 34-1:** Investigating the large range in estimates of per capita fish consumption in Kiribati

The high end of the range of per capita fish consumption is from Nube (1989) who reported that canned fish imports from 1974 to 1986 ranged from 112 t to 312 t per year. Using information from the 1985 census, Nube calculated the daily per capita fish consumption for 18 islands in the Gilbert and Line groups. The results ranged from 0.45 kg in South Tarawa to 2.86 kg in Arorae. Of the 18 islands listed, 11 of the islands (or 61%) had a per capita fish consumption rate greater than 1 kg/day.

The low end of the range of per capita fish consumption is from the World Bank (1995), which stated: "Per capita supplies [of fish] available for consumption are consequently quite high ranging between 72 and 75 kilograms per year over the last decade, as reported to FAO."

The FAO consumption figures came from the FAO Food Balance Sheets, which use production, imports and exports to determine the total supply of fish and per capita supply.

FAO generally uses fishery statistics reported to them by government fisheries agencies. The Kiribati Fisheries Division Annual Report 1994 (Fisheries Division 1995) shows there were no estimates of annual national catch made for that year and does not mention annual catch estimates for the previous several years.

An examination of FAO catch data for Kiribati by researchers from the University of British Colombia (Zylich et al. 2014) shows that: "The reconstructed total catch of Kiribati for the time period 1950–2010 was approximately 14% higher than the catches reported by the FAO on behalf of Kiribati".

The fish consumption information in the table and the figure can be placed in a wider context:

- Based on the predicted age structure of populations in the Pacific until 2030, the age–weight relationships typical of the region, and the fact that fresh fish consists of about 20% protein, an annual average per capita fish consumption of 34–37 kg provides about 50% of the recommended protein intake for people in Pacific Island countries and territories (Bell et al. 2009b).
- Most of the Pacific Island countries and territories exceed by a large margin the world average per capita fishery product consumption rate of 20.5 kg (FAO 2020).
- Iceland and Maldives have per capita fish consumption estimates of 91.2 kg and 84.6 kg, respectively. Those two countries frequently top the list of high fish consuming nations as the estimates used for the comparisons most often come from FAO.

## 34.2 Some issues in fish consumption

### Declines in fish consumption

One feature emerging from recent studies of fish consumption in the region is a decline in per capita consumption in several countries. As examples:

- The 2021 annual report of the Tuvalu Fisheries Department (TFD 2022b), citing the 2015/16 HIES, states: "Fish consumption was estimated at 72 kg/person/year (90 kg in the outer islands and 55 kg for Funafuti). Although this is still one of the highest consumption rates in the world, it also shows a decline over the past decade."
- In the Northern Mariana Islands, nearly half (45%) of the respondents in a recent survey reported eating "somewhat less fish" than they did a decade ago (WPRFMC 2022b).
- Futuna has a higher per capita fishery product consumption rate than Wallis, 34.6 kg vs 19.4 kg, respectively. This equates to a consumption rate for the two islands of 27 kg per resident per year, a considerable drop from 75 kg per resident per year in 2006 (DSA 2022).

Another way of considering declines in fish consumption rates in the region is to divide the coastal fisheries production in the region (which supplies most of the regionally produced fish for consumption in the region) by the population and track that figure over time. Table 29-9 (from chapter 29 of this book), repeated below as Table 34-2, shows a decline of 14% over 21 years – which is cause for major concern.

**Table 34-2**: Per capita coastal fishery production, 2007 vs 2014 vs 2021

| | Coastal commercial production (t) | Coastal subsistence production (t) | Total coastal production (t) | Total population | Per capita coastal fisheries production (kg/person/year) |
|---|---|---|---|---|---|
| 2007 | 44,789 | 109,933 | 154,722 | 9,591,000 | 16.1 |
| 2014 | 53,753 | 110,183 | 163,936 | 11,020,000 | 14.9 |
| 2021 | 49,963 | 123,961 | 173,924 | 12,550,000 | 13.9 |

Source: Gillett (2009a), Gillett (2016) and the present study; population from SPC/SDD

The decline in fish consumption seems similar to (and could be related to) the decline in participation in coastal fisheries of many PICTs mentioned in the Fisheries Employment chapter of this book. The drivers of the decline in per capita consumption in some countries are not well-studied. They could include increasing scarcity of fish, decreasing profitability of coastal commercial fishing, increasing price of fish relative to alternatives, increasing availability of alternatives, changing dietary preferences and rural-urban migration – or a combination of these factors.

## The consumption of pelagic fish

Recognising the limitations of coastal fishery resources in providing food to the region, there has been an increasing amount of enthusiasm and progress in the utilisation of pelagic fishery resources from industrial operations as food within the region. Much of the reason for this interest is from a high-level regional mandate. In 2015, Forum Leaders adopted the Regional Roadmap for Sustainable Pacific Fisheries setting out shared goals and strategies for the management of the region's tuna fisheries. The shared goals relate to sustainability, value, employment and food security, with the goals to be achieved over the 10-year period to 2024. The roadmap *inter alia* laid out a challenge: "The supply of tuna for domestic consumption in the region will increase by 40,000 tonnes per year by 2024." Tracking progress of this increase using a consistent methodology would be important.

Some of the ways in which greater use of pelagic fishery resources is occurring are:

- The sale of longline bycatch and non-export grade tuna at longline bases in the region. In Suva in 2017, local sales of longline fish equated to 17.8 kg per year for the 185,000 consumers in the greater Suva area. In New Caledonia in recent years, local sales of longline fish are about 6.7 kg/person/year for the entire territory. In Vanuatu in 2020, local longliner sales provided an average of about 3.3 kg of fish (whole fish equivalent) to each Port Vila resident.
- The leakage and sale of fish from purse seine transshipment. In Solomon Islands it is estimated that upwards of 300 t is brought ashore into the Honiara market (McCoy 2019). Tolvanen et al. (2019) estimate that transshipment is responsible for putting ashore in the region annually 1,818 t of pelagic fish.
- Canned tuna sold in regional markets: this has been estimated to be 2,600 t in Fiji, 3,000 t in the Solomon Islands and 3,300 t in PNG (FFA 2022a).
- Government initiatives in some countries to increase consumption of pelagic fish. As an example:

  > The Ministry of Fisheries in Tonga has an initiative geared to increasing the consumption of tuna. As reported in the 2020/21 Ministry Fisheries Annual report, the Non-Communicable Disease Project was started in 2016 and aimed at combating non-communicable diseases in Tonga with affordable tuna at price range T$7 to T$9 per kilogram. Foreign fishing vessels are required to offload 3.5 t of tuna for the project in high peak seasons and 2.5 t in low peak seasons. As part of the project for FY 2021/22, a total of 152 t of tuna was sold locally in Tongatapu and Éua.

The countries in the region where landings from locally based industrial fishing fleets contributed most to food security in 2016 were the Cook Islands (95% of the fleet landings), Samoa (33%), Tonga (25%) and Palau (8%). The lowest contribution to food security was found in the high volume primarily purse seine-fishing countries with, for example, only 0.02% of the locally based fleet's catch going to the local market in FSM (Tolvanen et al. 2019).

## Measuring fish consumption

Some fisheries specialists have the view that the coastal fisheries production estimated by a HIES is often relatively low (Gillett 2009b). On the other hand, despite the imperfections of the HIES for fisheries work, across the region the HIES methodology is relatively uniform compared to the variety of techniques used to derive the information in the "range of estimates" column.

There are several examples of different surveys producing different estimates of national per capita fish consumption. One is the Kiribati case in the box above. Another is a single SPC Pacific Regional Oceanic and Coastal Fisheries (PROCFish) study in Niue in which two different assessments suggested very different annual consumption rates (51 kg vs 112 kg) (Kronen et al. 2008a). In the earlier Benefish study (Gillett 2009a), there is an example of the difficulties in comparing fish consumption studies:

> In one Pacific Island country, a fish consumption study in 1998 (unknown methodology) was directly compared to a study in 2001 (using a mixture of food weight and whole fish equivalent) and one in 2006 (using food weight). Changes in per capita consumption between the surveys were calculated and attributed to specific factors (i.e. ciguatera, fisheries management measures).

Several observations can be made on the information in this chapter. One is that determining per capita fish consumption in the region is currently a very inexact science. Another is that comparisons between different fish consumption studies must be done cautiously, or even avoided, unless the methods used by the studies are known and they are either the same or can be corrected so that equal features are being compared. A third observation is that although different methodologies can give different results, the trend in consumption over time could be more useful than absolute values. These points emphasise the importance of using consistent techniques to monitor fish consumption.

Other issues to bear in mind when using the results of fish consumption studies are as follows:

- Terminology – for example "per capita fish consumption" can be the measurement of two very different things: (a) food ingested or (b) the whole weight of the fish used to produce the ingested food.
- "Seafood" is sometimes used in consumption studies, but this can create confusion in countries with a large production from freshwater fisheries.
- The food items being compared – whether just finfish or all aquatic animals, or even aquatic plants, are included.
- Canned fish – whether this is included and whether the quantity in the can (all edible) is being added to whole fish equivalents (not all edible).
- Fish imports and exports – (a) whether these are included, (b) how they are included in countries that have unreliable export statistics, and (c) determining from the statistics whether imports consist of whole fish or just the edible parts.
- Tourists – whether the tourist population is included in fish consumption studies, and whether there is any correction for differential consumption by tourists.

## Fish consumption rates and fisheries management

Per capita fish consumption data are important for determining the impacts of policy changes and management interventions, especially on small-scale fishers. Protection of village fish food supplies is arguably the most important objective of the management of subsistence fisheries in the Pacific Islands. Monitoring per capita fish consumption is important in determining the degree to which this objective is being achieved.

There are two other considerations regarding monitoring of fish consumption rates in relation to small-scale operations:

- The use of marine protected areas (MPAs) is now widespread in the Pacific Islands, and it is likely that this will increase. MPAs are established for many worthwhile objectives, including increasing the abundance of important species, protecting other species, biodiversity conservation and increasing the value of non-extractive uses (e.g. dive sites). To ensure that these multiple objectives are not being achieved at the expense of the diets of villagers living in the area, some monitoring of per capita fish consumption is important.
- In several countries, the objective of governments supporting aquaculture is to improve nutrition ("aquaculture for food security"). It would therefore seem logical to monitor per capita consumption of aquaculture production to determine if the support to aquaculture is justified on nutritional grounds.

In a wider context, fish consumption rates and their change over time can provide a powerful justification for emphasising improved government attention to fisheries management. Bell et al. (2009b) studied per capita fish consumption in the region and concluded: “Forecasts of the fish required in 2030 to meet recommended per capita fish consumption, or to maintain current consumption, indicate that even well-managed coastal fisheries will only be able to meet the demand in 6 of 22 PICTs.”

# 35 Some Other Features Emerging from the Study

In the course of collecting information for the present study and the subsequent analysis and write up, several features emerged that, although interesting, do not fit neatly into the previous chapters – but they deserve some additional attention. In the sections below they are explored or at least noted.

## 35.1 Contributions of the fisheries sub-sectors

This study examined fisheries production in six categories: coastal commercial, coastal subsistence, offshore locally based, offshore foreign based, freshwater and aquaculture. Several types of benefits from fisheries were studied: contributions to GDP, exports, government revenue, employment and nutrition. When the fishery categories are analysed in terms of types of benefits (Table 35-1), an interesting pattern emerges. A large part of the employment and nutrition benefits – the benefits that most directly affect Pacific Islanders – come from coastal fisheries; while the less tangible benefits (contributions to GDP, to exports and to government revenue) tend to come more from offshore fishing.

Table 35-1: Benefits by category of fishery

| | Contribution to GDP | Contribution to exports | Contribution to access fees | Contribution to employment | Contribution to food supply |
|---|---|---|---|---|---|
| Coastal Commercial | About 17.9% of GDP across the region | Substantial in some countries but across the region much less important than local-based offshore | Zero | Large in most countries | Very large |
| Coastal subsistence | About 38.9% across the region | Zero | Zero | Large in most countries | Very large |
| Locally based offshore | About 30.2% across the region | Large in countries with local fleets | Substantial in some countries where local fleets pay access fees | Substantial and growing with increasing local basing in the region | Significant in countries with local fleets |
| Foreign-based offshore | Zero | Zero | Large in most countries | Much less than locally based offshore | Significant in countries with lots of tuna transshipment |
| Freshwater | About 6.8% across the region, most in PNG | Almost nothing except a tiny amount from PNG | Zero | Only significant in larger islands of Melanesia | Only significant in larger islands of Melanesia |
| Aquaculture | About 6.1% across the region; 87% from 2 French territories | About 80% of the aquaculture production in terms of value is exported | Zero | Significant in French Polynesia and New Caledonia; of minor importance in most PICTs | Most aquaculture in terms of value is non-edible; most aquaculture production is exported[1] |

Source: The production, GDP, export, government revenue, employment and fish consumption chapters of this book

In the fisheries production section (Chapter 29), fisheries production in PICTs by fisheries sub-sector as estimated by three Benefish studies is given for the years 2007, 2014 and 2021, and a graph of this estimated fisheries production is repeated in Figure 35-1, below.

[1] Fiji, with its large amount of tilapia farming compared to most other PICTs, produced about 300 t of tilapia in 2021. That production was about 1/10 of one percent of the amount of food produced by coastal fisheries.

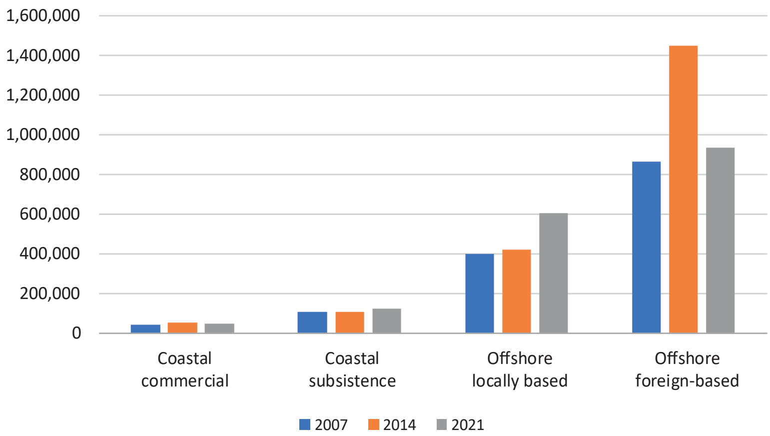



**Figure 35-1:** Regional totals in each fishery category, 2001 vs 2014 vs 2021 (t)

In the fish consumption section (Chapter 34), the per capita coastal fisheries production estimated by three Benefish studies is given for the years 2007, 2014 and 2021, and this estimated production is repeated in Table 35-2, below.

**Table 35-2:** Per capita coastal fishery production, 2007 vs 2014 vs 2021

| | Per capita coastal fisheries production (kg/person/year) |
|---|---|
| 2007 | 16.1 |
| 2014 | 14.9 |
| 2021 | 13.9 |

Source: Gillett (2009a), Gillett (2016) and the present study

Combining the three sets of information above leads to one of the most important findings of the present study: per capita coastal fisheries production in the region is declining. Considering that coastal fisheries produces most of the fish in the region for consumption by Pacific Islanders, this is serious.

The offshore locally based and foreign-based catches in the figure above require some explanation as there are several influencing factors. The locally based offshore catch increased considerably over the 2014–2021 period, despite the combined tuna catches by all vessels in the western and central Pacific Ocean being relatively low in 2021. The expanding Pacific Island purse seine fleet (Box 35-1) is likely to be a major cause of the increase. As to the decrease in the catch of foreign-based offshore vessels over the 2014–2021 period, it is likely that this was at least partly due to the fact that the expansion of local-based offshore purse seine fleet was to some degree at the expense of the foreign-based fleet. Problems with transshipment could also have contributed to the decrease. For example, transshipment in Majuro lagoon was down 40% due to restrictions on port entry.

**Box 35-1:** The expansion of the Pacific Island purse seine fleet

The total number of combined Pacific-island purse seine fleet vessels has gradually increased over the past two decades, attaining its highest level in 2021 (142 vessels); increases in these years include the reflagging and chartering of vessels from the Asian fleets. The combined Pacific-islands purse seine fleet covers vessels fishing under the FSM Arrangement, bilateral agreements and domestically based vessels and comprises vessels from the Federated States of Micronesia (FSM; 28 vessels in 2021), Kiribati (26 vessels), Marshall Islands (11 vessels), Papua New Guinea (PNG: 40 vessels including their chartered vessels), Solomon Islands (8 vessels), Tuvalu (6 vessels) and Vanuatu (7 vessels). Nauru purse seine vessels (2) entered the fishery for the first time in 2018 and their fleet has now grown to 15 vessels fishing in 2021. The Cook Islands entered the purse seine fishery in 2019 with 1 newly flagged vessel.

Source: Williams and Ruaia (2022)

## 35.2 Household income and expenditure surveys

The HIES is gaining popularity in the region as a fisheries tool. The results from the present Benefish study suggest that the HIES is the main way that national statistical agencies obtain coastal fisheries production information for GDP estimations. The HIES has also been used to estimate per capita fish consumption (e.g. Bell at al. 2009a). The new "fisheries friendly" HIES has been used to produce several kinds of fishery estimates.

With the growing popularity of HIES for fisheries work, there is some justification for scrutinizing its accuracy. Some fisheries specialists have the view that the coastal fisheries production estimated by a HIES is often relatively low (Gillett 2009b). Some consideration should be given to "ground truthing" the results of a HIES at a few locations with a fisheries-oriented survey, such as a village resource survey.

Another HIES-related difficulty encountered during the present Benefish study is mentioned in the Production chapter of this book. Typically, only a portion of data collected in a HIES appears in the published reports – and in many cases, most of the fisheries data from a HIES are not readily available. Access to the unpublished fisheries information (either straight from a national statistics office or through SPC's Statistics for Development Division) requires the authorisation of senior staff of the statistics departments, which is often difficult to obtain.

The general theme of the need for increased dialogue between staff of the fisheries agencies and that of the statistics offices has been mentioned in several sections of this book – and access to unpublished HIES data related to fisheries provides further justification for the dialogue.

## 35.3 Some common problems with collecting information on coastal fisheries

During the present and past Benefish studies, it was observed that government fishery agencies experience several types of difficulties in collecting information on coastal fisheries. Four types of problems were especially common, and therefore they should receive additional attention. These are (1) inability to expand sampled catches to obtain the total catch of a geographic area, (2) a single tonnage number for fishery production becoming institutionalised and inappropriately used over a long period of time, (3) the utility of "base-line surveys", and (4) overreliance on government statistics offices to know what information related to fisheries should be collected and how to collect it.

Increased attention is being focused on survey information from coastal fisheries – and this positive development is being supported by SPC and some of the main donors to the PICT fisheries sector. In some of the new statistical systems being established, and in some of the older systems being resurrected, it is not possible to expand the sampled catches to approximate total catches at the market, district, province or national levels. In other words, a lack of methodology (or a forgotten methodology) to go from what catch enumerators count to estimating catches on a much larger scale. In the present study, several cases were noted in which the sampled quantities are reported by fishery departments in such a way that they appear to be a national total. As an example, one country has taken the very positive step of producing an annual catch production report. The most recent version states: "the present report indicates that local fishery production in country XXX was about 239 tonnes in 2020", but that amount was simply how much fish was sampled during 2020. Several other similar examples from other countries could be cited. The type of difficulty mentioned in the above paragraph is surprisingly common in the region. Accordingly, there is a great need for advice to fishery departments on extrapolating results of catch sampling to obtain a provincial or national total.

Because many of the older national coastal fisheries statistical systems are decaying and there have been few national "snapshot" surveys in recent years, there is greater use of a tonnage production number (or sometimes a per capita fish consumption number) generated in the distant past. For lack of a better term, this is referred to as "inappropriate recycling of antiquated information". In one country, the tonnage production from subsistence fisheries was used (with minor adjustment) for over 30 years. To mitigate this situation, if a fisheries agency cannot afford some type of snapshot fisheries survey, consideration should be given to obtaining information from studies outside the fisheries sector: e.g. a HIES, agriculture census or national census. The key to assuring relevance of those surveys to fisheries is cooperation between fisheries and statistics agencies.

In the present study, when fisheries officers were asked for information on the amount of national coastal fisheries production, reports of surveys to produce "baseline information" were often provided. Those were not very helpful. Although it is recognised that the objective of those surveys was not to produce national catch estimates, with some attention to site selection for the baseline survey (i.e. chosen to approximate the range of fishery conditions in a country), the information could be of some use in producing national coastal fishery production estimates – or ground truthing previous estimates.

A surprising finding of the present study was how much fisheries information is produced by national statistics offices. This includes data from surveys of fishing companies for GDP and employment purposes, national census work that provides information on participation in fishing, compiling/analysing export statistics and participation in agriculture/fisheries censuses. It is becoming increasingly clear that reliance on government statistics offices to know what fisheries-related information is useful and how to collect it simply does not work. Considerable technical knowledge of the sector is required to collect meaningful information. Government fisheries officials and fishing industry participants have an important role to play in working with statistics offices in fisheries work – defining terms/categories, formulating survey strategies, and scrutinising survey results – in order to obtain results that are accurate and useful.

## 35.4 Annual reports of government fishery agencies

The 2016 Benefish study reported that over the period 2001–2015 one of the most striking changes in relation to measuring fisheries benefits was the reduction in the amount of fisheries information that was readily available. In the past, one of the most important tools for learning what was happening in a national fisheries sector was the annual report of the government fisheries agency. These reports provided information useful not only for regional fishery researchers, but also for national fishery stakeholders, other government agencies, the media and the general public. They also served to promote the profile of the fisheries sector and provide some degree of accountability of the fisheries agency, including in several countries transparency of finances. For various reasons, most fisheries agencies of the region do not currently produce a good annual report. A good annual report is taken to be one that gives accurate and concise information on the activities of the agency and on fisheries of the country and is produced in a timely manner. Given the commitments made by national governments to various regional targets (e.g. consumption of 40,0000 t of pelagic species) in the various roadmaps and plans, annual reports could be the avenue by which national contributions to those regional targets can be assessed and compiled.

The 2016 Benefish study specifically cited the 2015 annual report of the Marshall Islands Marine Resources Authority (MIMRA) as being exemplary. During the present study, special attention was paid to the issue of annual reports. Some of the observations made are:

- MIMRA continues to produce an excellent annual report on a timely basis.
- Tuvalu produced a very good annual report in 2016, apparently with the assistance of SPC. From that period up to the present, annual reports of equal quality were produced – presumably without the assistance of SPC.[2]
- The Annual Report 2018–2019 of Fiji's Ministry of Fisheries is a remarkable improvement over the reports of previous years, but its publication was delayed due to reasons related to other ministries.
- For many years (including recent years), the annual report of Tonga's Ministry of Fisheries has been produced on time.
- Many of the other government fishery agencies in the region have either abandoned the idea of producing an annual report or publishing the report so late that it has little value.

## 35.5 Aquaculture statistics

The scarcity of information about national aquaculture production was a significant finding of the present study. Two examples are cited here, but the situation arises in most PICTs:

- A surprising feature of aquaculture in Fiji is the lack of knowledge of the overall production. The absence of a formal system for collecting

[2] There was no SPC logo on the cover.

aquaculture statistics makes it difficult to obtain a good idea of production volumes and values. On a simpler level, there have been few efforts to use various types of local knowledge to make even gross estimates of production of the major aquaculture commodities (which could be refined over time).

- Considering the amount of money used over the last several decades to develop aquaculture in FSM, it is astonishing how little is known about current production. With the readily available information (i.e. that accessible to the present study), it is not even possible to make an educated guess at the current annual aquaculture production in FSM.

As mentioned in the Production chapter of this book, one of the most outstanding points about aquaculture in the region – and perhaps one of the most remarkable observations during the present study – is the lack of knowledge of the overall aquaculture production in almost every PICT. In the course of this Benefish study, despite internet searches, discussions with national and regional aquaculture authorities, consultations with private sector aquaculturalists, and interaction with an author of a recent regional review of PICT aquaculture, not a single document was identified that gave national aquaculture production. Furthermore, in only two PICTs (PNG and French Polynesia) was it possible for the authors of the present study to find an individual who could summarise national aquaculture production. Considering the enormous amount of development funds and public money spent on promotion of aquaculture in the region, it is amazing that there is so little monitoring of the progress of aquaculture development in terms of the total volume and value of production. One wonders how progress in aquaculture is determined, or how the effectiveness of past development efforts is gauged, or if more spending on aquaculture promotion in the future is justified. The other aspect of this issue is that compared to the difficulty of monitoring small-scale fisheries, tracking aquaculture production is not very difficult: the ponds do not move around, several types of remote sensing are applicable, and ongoing subsidies for many aquaculture operations provides an entry point for monitoring.

Other important aspects concerning aquaculture statistics in the regional are:

- The recent review of aquaculture in the region (IAS 2022) recognised this problem: "The Pacific aquaculture sector is very data-deficient, affecting planning and investment in the sector," "Identified priority needs include….. better data collection, storage, analysis & dissemination", "Data on aquaculture in the region is generally very poor, affecting decision making," and "The consequential inability to monitor or manage the industry puts very real barriers in the way of development". The report recommended 14 strategic priorities for aquaculture, including "Strengthen data and information collection and analysis for monitoring the progress and contributions of aquaculture".

- A recent FAO report of aquaculture in the region (Mori et al. 2022) states "Growth and development of the sector is further inhibited by a general lack of production and trade data."
- An older SPC review of aquaculture in the region (Hambrey Consulting 2011) recommended "Strengthen aquaculture statistics and data bases".
- Forty years ago, a review of aquaculture in the region (Uwate 1984) noted the need for information on aquaculture production.

Despite the reality in countries and the four reviews above, the problem of aquaculture statistics is still not receiving much attention and it seems that little progress is being made. Although the issue was mentioned in the section on key priorities in the recent paper "SPC FAME priorities and emerging work areas in 2023", it appears the support on offer from SPC in the area of aquaculture statistics is limited to "web-based data applications".

## 35.6 Effectiveness of coastal fisheries management

In collecting information during the present Benefish study, travel was undertaken to almost all of the Pacific Island countries and territories. The general impression was that in many places, the effectiveness of coastal fisheries management has declined. There is no shortage of dismal news of deterioration in coastal fishery resources. This may have many causes, and certainly there are large differences between countries. Probable reasons include the following:

- Mostly unsuccessful attempts to use reef ranching and reef enhancement as a substitute for management.[3]
- The ineffectiveness of other interventions perceived to be easy alternatives to restrictive management (e.g. the use of alternative livelihoods).
- Increased attention to offshore fisheries management at the expense of coastal fisheries management (i.e. gravitation of budgets and effective staff to the tuna fisheries).
- Fisheries close to urban areas being unmanageable.
- Disappointing results from past intervention in coastal fisheries management leading to fisheries agency fatigue.

[3] As expressed by one regional fisheries specialist, "the futility of trying to use good aquaculture to make up for bad fisheries management".

- Political pressure for interventions that lead to increasing coastal fisheries production (e.g. donations of boats, engines and gear) and happy fishers with their political support – at the expense of resource sustainability.
- Increased attention to the narrow issue of reef shark conservation at the expense of broader coastal fisheries management.

Regarding the point above on reef ranching and reef enhancement, there appears to be a considerable amount of enthusiasm in several countries that those activities will compensate for overexploitation of coastal fisheries resources. It should be noted that three decades ago there was a detailed study of the effectiveness of reef ranching and reef enhancement in the region (Preston and Tanaka 1990)[4] which concluded that these activities "need to be considered as part of an overall management approach and not as an alternative to management. Overseas experience underlines the fact that simply releasing large numbers of juveniles into the fishery will not produce population increases unless the fishery is also subject to some form of management that allows the released juveniles to reproduce and thus make a contribution to population growth. Aquaculture resource enhancement should be viewed as one of a set of management tools, and not as an easy way out of management." In reconciling this statement with the current enthusiasm for reef ranching and reef enhancement, perhaps there is a need for SPC to revisit the subject and provide guidance to PICTs.

Regarding the dismal news of deterioration in coastal fishery resources mentioned above, the current outcomes of coastal fisheries management in the region are not all bad. There are many positive cases in the region (e.g. Navakavu in Fiji and Ontong Java in the Solomon Islands). Consideration should be given to publicising those examples to create a more positive image for coastal fisheries management.

## 35.7 The impacts of climate change on fisheries

The present study covered topics that were not included in the previous Benefish studies. The scope of this study was expanded to cover the impacts of both climate change and Covid on fisheries contribution to economies where there are data available on impacts, changes or trends. This sub-chapter is about the impacts of climate change and the following one is about the impacts of Covid.

[4] One of the positive aspects of the study is that one of the authors was an aquaculture specialist and the other was a coastal fisheries management specialist.

During the study, in the interviews conducted with fisheries specialists (primarily senior officials of government fisheries agencies), the impacts of climate change on fisheries were explored. The discussions were focused on what impacts had occurred in their countries (and any data associated with the impacts), rather than predictions of what may happen in the future.

The information obtained in the discussions is summarised in Table 35-3, below. The tabled information should not be considered an exhaustive exploration of the subject, but rather observations by individuals who have good knowledge of fisheries in their countries.

**Table 35-3:** Observations on the impacts of climate change on fisheries and associated data

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| Cook Islands | Senior fisheries officers | No solid evidence of impacts of climate change on fisheries; only anecdotal information. Have noticed very warm water at some islands (e.g. Palmerston). Any change of coastal fish abundance by climate change is overshadowed by overexploitation of fish. A research group from French Polynesia will soon be monitoring fish, coral, waves and temperature. |
| Federated States of Micronesia | Senior fisheries officers from national level | Have noticed that coral bleaching is occurring more often, but not entirely sure that this is directly caused by climate change, or if coral bleaching has a significant impact on fish abundance.<br><br>Researchers at the University of Guam have documented that the 2015–2017 El Niño–Southern Oscillation (ENSO) resulted in significant mortality of corals in FSM, followed by a short-term increased in fish biomass.[5] |
| Fiji | Senior fisheries officers; NGO leaders | Most notable impact of climate change is coral bleaching. Lots of studies on change of coral condition/habitat but not on the associated change in fish abundance. Climate change has probably increased the severity of cyclones but not the frequency. |
| Kiribati | Fisheries consultant, fish exporter and literature | Coral bleaching in the island groups of Kiribati is documented in Kiribati: Atolls and Marine Ecosystems (Mangubhai 2019).[6]<br><br>A 2002/03 bleaching event in the Phoenix Islands resulted in losses of coral of 12–100% at individual sites. Changes in fish abundance were not uniform and only three of the 13 fish families recorded significant differences post-bleaching (Mangubhai et al. 2014).[7] |

[5] Houk P., McInnis A., Benavente D., Gaag M., Maxin S. et al. 2022. Climate change disturbances contextualize the outcomes of coral reef fisheries management across Micronesia. PLOS Clim 1(7): e0000040.

[6] Mangubhai S. 2019. World Seas: An Environmental Evaluation. https://doi.org/ 10.1371/journal.pclm.0000040.

[7] Mangubhai S., Straunch A.M., Obura D.O., Stone G. and Rotjan R.D. 2014. Short term-changes of fish assemblages observed in the near-pristine reefs of the Phoenix Islands. Rev. Fish Biol. Fisheries 24: 505–518.

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| Marshall Islands | Senior fisheries officers (coastal and offshore) | In the short-term, it is hard to see impacts on fisheries. "No solid data for impacts of climate on fisheries", but "there is local knowledge." Because it is expected that most impacts are on coastal fisheries, there is currently monitoring of coral bleaching and the subsequent recovery. For offshore fisheries, "SPC has the data on the impacts of climate change". |
| Nauru | Mid-level fisheries officers | The staff spoken to have the notion that climate change has had some role in the decline of fish abundance – but there have been no specific studies on this issue. |
| Niue | Director General of Department of Agriculture, Forestry and Fisheries | "There is not yet any hard data available on the impacts of climate change on fisheries in Niue." |
| Palau | Senior officers of the Bureau of Fisheries; Head of research institute | The Bureau of Fisheries has no data on the impacts of climate change: "maybe there is some data on the Palau International Coral Reef Center." PICRC staff indicate that there is a clear effect of climate change on corals (i.e. increased bleaching in the last 20 years), but there has been no work that shows the impact of coral bleaching on fisheries. |
| Papua New Guinea | Senior and mid-level staff of the National Fisheries Authority | There is awareness that tuna that are the target of the purse seine fishery are predicted to move to the east according to SPC scientists – but there is a lack of hard data to show that this has happened yet. |
| Samoa | Senior and mid-level staff of the Fisheries Division | The Fisheries Division staff spoken to were not aware of any specific examples of climate change having an impact on fisheries. |
| Solomon Islands | Leadership of the Ministry of Fisheries and Marine Resources | The Ministry does not have data on the impacts of climate change on fisheries. The Coral Triangle Initiative and some non-governmental organisations (NGOs) may have done some work on the impacts at the community level. Modelling by SPC indicates that the surface fisheries for tuna will move to the east, but there is no evidence of this as yet. |
| Tonga | A meeting with all senior staff of the Ministry of Fisheries | Concern about the impacts of climate change on fisheries is completely overshadowed by concern of the impacts of the volcanic eruption and Covid. |

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| Tuvalu | National fisheries consultant and expatriate fisheries adviser | There are numerous mentions of climate change in the fisheries literature of Tuvalu – but much of that consists of projections of what may occur and the setting up of monitoring programmes. There is limited information on the actual impacts to date of climate change on fisheries, which appears to be largely limited to anecdotes such as: "A creel survey began in April 2015. By 1.5 years into the survey, 227 landings were met and measured in Funafuti. When interviewed, 85% of Funafuti's fishers said that the amount of catch had declined. The main reasons fishers gave for the declining resources included too many fishers and boats, and climate change."[8]<br><br>An alternative view is that there is no evidence of any kind of impact of climate change on fisheries. The creel survey mentioned above only gives evidence of the impact of the climate change narrative in the minds of the fishers. |
| Vanuatu | Leadership of the Vanuatu Fisheries Department | No specific impacts of climate change on fisheries in Vanuatu have been documented – only some informal observations (which includes a mass fish kill in 2018/19 due to a marine heatwave). There is some information on coastal area losses, but that has not been related to fish catches. There is some information on the increase in crown-of-thorns starfish, but it is not known if their abundance is related to climate change. There is no data on ocean acidification in Vanuatu. |
| American Samoa | Senior staff of the Department of Marine and Wildlife Resources | There is a need to integrate climate studies into fisheries studies – but not sure what kind of climate data to collect. |
| French Polynesia | Senior staff of the Direction des ressources marines | The weather office collects data on air temperature – and the temperature has increased but it is not obvious how this affects fisheries. Sea surface temperatures are now more extreme than in the past, but the fisheries impact is unknown. |
| Guam | Senior staff of the Division of Aquatic and Wildlife Resources | The known and/or speculated impacts of climate change on fisheries are: (1) changes in seasonality of some fish species (e.g. mahi mahi, wahoo); (2) increased incidents of unusual weather (e.g. never saw waterspouts before); (3) in the period 2013–2017 there was coral bleaching in 4 years out of 5, which was never this common in the past; and (4) bottomfish are fished deeper these days. The marine Lab of the University of Guam has been monitoring coral for about 50 years. |

[8] Makolo F., Taula H., Petaia L., Paka L., Petaia M. et al. 2017. Funafuti Lagoon Reef Fisheries Management Plan: Optimising our use and benefits from fisheries. Department of Fisheries, Ministry of Natural Resources, Tuvalu. 35 pp.

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| New Caledonia | Staff of Province Sud Département de l'aquaculture et des pêches | There have been no studies and therefore no data on the impacts of climate change on fisheries. There is some conjecture on the impacts (e.g. more crab recently). In 2023 the Institut de Recherche pour le Développement (IRD) will start a study on the impacts of climate change. |
| Northern Mariana Islands | Staff of Division of Fish and Wildlife | [no data] |
| Tokelau | Fisheries Adviser | An El Niño is good for purse seine tuna fishing in the Tokelau zone, and there are indications that El Niño events are more common with climate change. Sea walls around the populated islands are being destroyed but not sure this can be tied to climate change. |
| Wallis and Futuna | Senior staff of the Service de la pêche et de gestion des ressources marines | No obvious impacts of climate change on fisheries |

From the above table, several features emerge. Some of the common statements made during the interviews (which are probably applicable to many of the countries) are:

- Coral bleaching is more common now than in the past (but from interviews, apparently only Guam and PICRC have lengthy historical records).
- The tuna that are the target of the purse seine fishery will move to the east (according to SPC scientists) – but there is a lack of hard data to show that this has happened yet in the countries concerned.
- Climate change has definitely impacted marine habitats, but it is not certain how those impacts affect fisheries.
- Any change of fish abundance by climate change is overshadowed by the overexploitation of those fish.
- Although prompted, none of the interviewees offered any information or comments on the impacts of climate change on aquaculture.

On a more general level, it became apparent during the interviews that many fisheries officers are not very familiar with climate change and many of the answers are "all over the place". The impression was obtained that among fisheries officers, climate change is not perceived to be the most serious problem confronting the fisheries sector. Recent discussions with a marine climate change specialist (J. Johnson, per. com. April 2023) revealed a similar finding. That specialist conducted a series of climate adaptation workshops over a two-year period and learned that Fisheries Department staff believed that climate change is an issue for fisheries, but those staff seemed unsure why it is an issue.

In terms of actual data on the impacts of climate change on fisheries, during the interviews and subsequent follow-up, only a limited amount of data was encountered. Although there has been much monitoring of coral bleaching in the Pacific Islands area, data on the impacts on fisheries of that bleaching in the region were found during the study in only two cases:

- A 2002/03 bleaching event in the Phoenix Islands resulted in coral losses of 12–100% at individual sites. Changes in fish abundance were not uniform, and only three of the 13 fish families recorded significant differences post-bleaching (Mangubhai et al. 2014).
- Researchers at the University of Guam have documented that the 2015–2017 ENSO resulted in significant mortality of corals in FSM. That mortality led to replacement with algae and detritus, followed by a doubling of biomass across all fish guilds that was proportional to their starting points for all islands (Houk et al. 2022).

It should be noted that the above two studies linked a climate change-induced incident to changes in fish abundance rather than to a change in fishery production or a change to a fisheries-related benefit. No other data sets of the impacts of climate change on fisheries were encountered during the present study.

To effectively detect the impacts of climate change on fisheries, it appears that much better monitoring of fisheries is required. This raises the question of priorities for fisheries monitoring – whether it should be oriented to fisheries management objectives or to detecting changes caused by climate change.

In 2011 SPC published the book "Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change".[9] That publication is currently being updated and is expected to be released in 2024. It will feature a more thorough discussion of the impacts of climate change on fisheries in the Pacific Island region.

## 35.8 The impacts of Covid on fisheries

As mentioned above, the present study covered topics that were not included in the previous Benefish studies. The scope of this study was expanded to cover the impacts of both climate change (previous sub-chapter) and Covid (this

[9] Bell J.D., Johnson J.E. and Hobday A.J. 2011. Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change. Noumea, New Caledonia: Secretariat of the Pacific Community. 925 p. https://purl.org/spc/digilib/doc/en9j3

sub-chapter) on fisheries contribution to economies where there are data available on impacts, changes or trends.

During the study, in the interviews conducted with fisheries specialists (primarily senior officials of government fisheries agencies), the impacts of Covid on fisheries were explored. The information obtained of those impacts on specific fisheries and the associated data (if available) are given in the production sections of the country chapters of this book.

In the table below, the most significant impacts of Covid, as perceived by the specialists interviewed, are summarised.

**Table 35-4:** Observations on the most significant impacts of Covid on fisheries in PICTs

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| Cook Islands | Senior fisheries officers | With the Covid-induced disappearance of tourism and knock-on effects, many people became unemployed (especially in Rarotonga and Aitutaki), and they began searching for new opportunities – and one of those was subsistence fishing. In general, Covid caused more local food production, including that from fishing. Other important impacts of Covid were an increase in fishing in MPAs and a decrease in the price of tuna in Rarotonga due to the lack of tourist market for tuna. The northern islands were cut off from Rarotonga and the north/south fish trade stopped. |
| Federated States of Micronesia | Senior fisheries officers from national level | The price of fuel for coastal fishing increased substantially, causing the price of fish in the local markets to rise. Both small-scale farming and fishing increased, but these increases were mitigated to some degree by (1) immigration to the United States and (2) stimulus checks from the FSM government. The bartering of vegetables for fish from transshipping vessels stopped, contributing to a decrease in the supply of fish in transshipment ports. Foreign-based vessels fishing in the FSM zone were subject to strict enforcement of the Covid rules, so many vessels moved to the zones of neighbouring countries with less rigorous enforcement, reducing the tuna fishing effort in the FSM zone. |
| Fiji | Senior fisheries officers; NGO leaders, tuna industry representative | Tourism crashed, causing massive unemployment and less demand for high-end seafood at resorts and restaurants. Many Fijians previously employed in the tourism sector returned to their villages and survived on fishing and farming activities for self-consumption. There were restrictions on coastal fishing activity, limited movement through fish markets, and restrictions on public transport to get to fishing grounds and markets. For the locally based longliners, limited air cargo space and (later on) high air cargo rates encouraged many of the fresh-fish longliners to convert to frozen fish. To some degree, the impacts of Covid on fisheries cannot be disentangled from other disasters and events: the opening of the beche-de-mer fishery, the spectre of 30% of the Fiji zone being closed to longline fishing and three major cyclones. |

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| Kiribati | Fisheries consultant, fish exporter, and literature | Aside from the Tarawa troll fleet, there was a reduced amount of coastal commercial fishing activity and more purchasing of food from stores. Sales of fish rejected during transshipment stopped completely, encouraging increased production from the Tarawa troll fleet. Less is known about the impacts of Covid on the offshore fisheries due to the suspension of the observer programme during the pandemic. |
| Marshall Islands | Senior fisheries officers (coastal and offshore) | In coastal fisheries, there was an increase in subsistence fishing and a decrease in marketing opportunities for coastal commercial fishing. This included a large reduction in fish collection from the outer islands as the collection vessel was used for other purposes (delivery of medical teams, supplies and equipment). Covid affected the ability to export marine aquarium products. Covid also caused the collapse of the "cooler trade" of shipping fish to Hawaii as personal baggage on passenger flights. In offshore fisheries, after the lowest number of vessels transshipping in a decade in 2020 (175 transshipments), the number rebounded to 297 in 2021. Pan Pacific Foods did not process fish in 2021 due to a number of factors, including Covid. The tuna catches by foreign-based vessels in the Marshall Islands zone actually increased during Covid. |
| Nauru | Mid-level fisheries officers | During the strict lockdown (June/July 2022), all movements were restricted and apart from essential workers, everybody had to work from home. It is likely that coastal fisheries production did not fall much during Covid because procuring fish was considered an essential activity. The foreign-based offshore fishing catches in the Nauru zone during 2021 and 2022 actually increased from that of 2019. |
| Niue | Head of Dept. of Agriculture, Forestry and Fisheries | Covid did not affect coastal production much because Niue receives a significant amount of goods from overseas. Consequently (and contrary to expectations), subsistence fishing did not seem to increase significantly. There was no offshore fishing in the Niue zone in 2021 – but this was due to reasons other than Covid. |
| Palau | Senior officers of the Bureau of Fisheries; Head of research institute | Tourism collapsed (from 89,379 tourists in 2019 to 3,400 in 2021) and it is likely that the resulting unemployment led to an increase in subsistence fishing activity. The longline catch in the Palau zone decreased from 2601 t in 2019 to 0.56 t in 2020 – but the decline was almost all due to the full implementation of the Palau National Marine Sanctuary, rather than Covid. There are two milkfish farms in Palau, but because they rely on fry from the Philippines and Taiwan, they stopped production during Covid due to lack of air cargo service. |

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| Papua New Guinea | Senior and mid-level staff of the National Fisheries Authority | Covid had minimal impact on the rural supply chain of fishery resources. The restrictions on movement of rural people were not severe and allowed consumers to move freely to the rural markets. Rural markets operated as normal, and supply of fish to those markets continued as normal. In contrast, the town or urban markets experienced low fish supplies during the Covid pandemic simply because of the fear fishermen had of contracting the virus when in town or mixing with urban community. There was evidence of stockpiling by urban consumers of tin fish. The sale of fresh fish at urban markets was suppressed as a result. Consequently, fishermen fishing into urban markets experienced loss of income. Despite Covid, production from the tuna processing plants (largely fed by the PNG domestic fleet) consistently increased by 10% year on year from 2019–2021. Although purse seine catches in the PNG zone increased during the Covid years, the pandemic had a large negative effect on the 2020 longline catch in the zone due to the difficulty of accessing markets in Japan and the United States. |
| Samoa | Senior and mid-level staff of the Fisheries Division | There was an increase in small-scale fishing activities during Covid due to many people having nothing else to do during the pandemic. Because there was restricted access to urban areas, there was reduced activity in the fish markets (e.g. fewer sellers and closed Saturdays/Sundays). In general, in 2020 and 2021 it is likely that Covid led to a reduced amount of coastal commercial fish production and an increase in subsistence fishery production. Fishery exports fell substantially between 2019 and 2020 and again between 2020 and 2021. Likewise for the catches of the locally based longliners. |
| Solomon Islands | Leadership of the Ministry of Fisheries and Marine Resources | During the pandemic, many residents of urban areas and students returned to their villages, and there was an increase in participation by those returnees in simple fishing activities that did not require specialised knowledge or gear. The marketing of fish from other islands to Honiara was curtailed. Overall, during the Covid period, it is likely that there was a substantial decrease in coastal commercial fishing and a lesser increase in coastal subsistence fishing. Coastal fishery exports declined remarkably in the period 2014 to 2021. For the offshore fisheries, the volume of the longline catch dropped substantially between 2019 and 2020, presumably due to the impacts of Covid – however, the lack of observers on pole-and-line and longline vessels could have resulted in less reliable data. |

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| Tonga | A meeting with all senior staff of the Ministry of Fisheries | The volume of snapper exports in 2020 was about the same as in 2014 but dropped to zero in 2021 due to Covid. By contrast, the impacts of Covid on coastal commercial fisheries, except for snapper, was not great (i.e. fishers allowed to go fishing) and certainly much less than that caused by the volcanic eruption in January 2022. The national fleet increased its total catch harvested and exported between 2020 and 2021, despite the decrease in the number of active vessels. The annual tuna and bycatch harvest for foreign-flagged vessels in 2021 was 1,759 t compared to 1,958 t in 2020. |
| Tuvalu | National fisheries consultant and expatriate fisheries adviser | Covid is thought to be largely responsible for a net movement of people from Funafuti back to their home islands – and an increase in farming and coastal fishing on those islands. In coastal fisheries, the percentage of undersize fish landed doubled in 2021 and was thought to reflect an increased reliance on coastal fisheries resources due to lack of affordable protein alternatives as a result of Covid-related restrictions. In offshore fisheries, the overall catch for the Tuvalu longline vessel in 2021 was 95 t, a considerable drop from the 147 t in 2020 and 225 t in 2019 – but factors other than Covid could have contributed to this decline. In 2021 a total of 69 transshipment visits were reported, a 53% drop from the previous year and the lowest for the past seven years. |
| Vanuatu | Leadership of the Vanuatu Fisheries Department | Covid caused an increase in coastal subsistence fishing and to a lesser degree, coastal commercial fishing. Much of this increase was because rural residents working in the tourism industry lost their jobs when the borders closed, and they returned to their home villages where the quickest/easiest way for them to get food and money was coastal fishing. Another impact was that many community-based reserves were opened during Covid. In 2020 and 2021, with air freight curtailed by Covid, most if not all exports by locally based offshore vessels were containerised whole frozen fish sent to China for loining and then to California for canning. |
| American Samoa | Senior staff of the Department of Marine and Wildlife Resources and literature | Subsistence shore-based fishing increased as more people went fishing during Covid. No decline in catch rates was evident in the data collected. Small boat fishers had trouble selling to restaurants catering to the local population due to capacity and opening restrictions on restaurants and other businesses. A different kind of Covid impact was felt by the industrial fisheries, due mostly to restrictions in the movement of fisheries labour and materials because of severe restrictions on air travel and in some cases, container ships. These travel restrictions affected the purse seine and longline fishery, as well as the Starkist Samoa cannery. For the purse seine fishery, port restrictions meant that crew could not leave their vessels. For the longline fishery, the border restrictions made it much harder to find crew because many of the fishing crew originate in Apia. |

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| French Polynesia | Senior staff of the Direction des ressources marines and literature | Much of the commercial lagoon fishing in French Polynesia occurs in the lagoons of the Tuamotu Archipelago for shipment to markets in Tahiti. During the Covid period, because of reduced transport to Tahiti, commercial lagoon fishing of the Tuamotu Archipelago was considerably reduced. Also to be considered is that the fish catches from the Tahiti-based longliners, when marketed in Tahiti, can reduce demand for lagoon species. The production from those longliners did not decline during Covid, but exports were curtailed due to lack of overseas air service, putting a substantial amount of additional long-line fish on the Tahiti market. The impact of Covid on aquaculture was mainly on the marketing of pearls. International sales were severely restricted and consequently, many pearls were stockpiled for sale in the future. Covid had a large impact on the fishery exports of the territory. Most commodities suffered in 2020, but many (pearls, aquarium products and fresh tuna) bounced back in 2021. Although there are few supporting data, there is the notion that fish consumption increased in French Polynesia (or at least in the urban areas) because of the increase in local availability of longline fish due to difficulties in exporting that fish. |
| Guam | Senior staff of the Division of Aquatic and Wildlife Resources | The proportion of coastal fish harvested by subsistence fishers (as opposed to that by coastal commercial fishers) increased during the Covid period. During Covid, fish markets were closed and there were restrictions on shore fishing. Fishers could still fish in the ocean from boats, but due to closed fish markets, catch disposal was a problem – so informal markets developed. The coastal commercial catch dropped from 916 t in 2019 to 836 t in 2020 – but factors other than Covid could have been involved. |
| New Caledonia | Staff of Province Sud Département de l'aquaculture et des pêches | Between 2019 and 2021, all of the following declined: number of coastal professional fishers, number of coastal fishing boats, declared coastal catch in tonnes and coastal sales revenue – but factors other than Covid could have been involved. The sea cucumber harvest increased in 2021 – but this is thought to be from new fishing grounds rather than an effect of Covid. Cultured shrimp is by far the most important fishery export of the country, and the exports of that commodity were fairly steady until 2021 when Covid reduced global demand. |

| | Type of stakeholders interviewed | Observations |
|---|---|---|
| Northern Mariana Islands | Staff of Division of Fish and Wildlife and literature | There was a massive reduction in tourism workers during the Covid period. The major impacts of Covid on fisheries were:<br>• Reduced demand for fish from the large tourism industry.<br>• The formal fish markets closed, but roadside fish vendors continued with increased throughput.<br>• The ice-making facilities were closed.<br>• Subsistence fishing effort, especially shore-based, increased to compensate for reduced ability to buy food.<br>• Commercial fishing effort decreased due to marketing difficulties. |
| Tokelau | Fisheries Adviser | Coastal fishing did not change much during the Covid period: "completely the same". For offshore fisheries, the major change was the lack of observers on foreign vessels operating in the Tokelau zone. There was not much change in the production of the purse seine or longline fisheries during the Covid period. |
| Wallis & Futuna | Senior staff of the Service de la pêche et de gestion des ressources marines | During Covid, the territory was largely isolated from the world. This isolation caused some food shortages, creating at least some incentive for increasing fishing activity – but in general, Covid had a "detectable but minor impact on fisheries". |

From the above table, several features emerge:

- The effects of Covid on fisheries were largest in places dependent on tourism and places dependent on airfreighting fishery products to markets.
- The effects on fisheries were smallest in isolated places where fisheries are oriented to local consumption.
- The types of aquaculture most affected by Covid were those operations involving international trade. On the input side, this involves supplies of fry and feed. On the output side, this involves overseas markets such as that for aquarium products, pearls and shrimp.
- Many PICTs had other shocks to fisheries that occurred about the same time as Covid, and it was difficult to disentangle the impacts on fisheries of Covid from the impacts of those shocks. This included a large dengue outbreak in the Marshall Islands, the volcanic eruption in Tonga, cyclones in Vanuatu and Fiji, the opening of the beche-de-mer fishery in Fiji, and the declaration of a large pelagic MPA in Palau.
- Two other developments that occurred in the Covid period were (1) marine protected areas being opened to increase fish production (e.g. the Cook Islands and Vanuatu) and (2) the emergence of informal markets to

avoid restrictions on established markets (e.g. Northern Mariana Islands and Guam).

- A surprising and positive impact of Covid was the increase in fish consumption in some places (e.g. Papeete) due to the increased availability and lower price of longline fish caused by difficulties exporting those fish.

Although Covid affected the fisheries in each PICT in different ways, the general impact of Covid on fisheries in many PICTs was depressed coastal commercial production and moderately elevated coastal subsistence production. For the offshore fishery operations, it appears that the impacts were greatest in 2020 and by 2021, many (but not all) of those impacts were mitigated.

Some comments can be made on the data that are available to show Covid impacts on fisheries. Where data are available to the present study, they are given in the country chapters of this book under types of fisheries (e.g. coastal commercial fishing). The general situation is that production data are available for some coastal fisheries and more elaborate data are available for most of the offshore fisheries in the region. During the Covid period, the available data for both the coastal and offshore fisheries show rises and falls, but often those changes cannot be attributed to only Covid – or in some cases, even partly attributed to Covid. In the table above there are several statements such as "The catch dropped from XXX t in 2019 to ZZZ t in 2020 – but factors other than Covid could have been involved". Another complication of ascertaining the impacts of the Covid period on fisheries is that in most PICTs, there were several "Covid sub-periods" (e.g. restrictions on movements, closed borders, strict lockdowns) – and sometimes the impacts of Covid on fisheries were very different between the various sub-periods. For the impacts of Covid on a regional basis, the timing of the sub-periods varied considerably between countries – for example, Nauru did not have its first Covid case until after Fiji largely returned to normal.

# 36 Recommendations

## 36.1 Priorities for information collection

Prior to a discussion of ways to improve the measurement of the types of fishery benefits covered in this book (presented in the next section), it may be useful to consider what types of information should be collected by PICTs and how they should be reported on.

Ideally, the present study would make recommendations on a specific type of fisheries data that a PICT should collect. However, this may be difficult for two main reasons:

- The PICTs all differ in terms of fishery issues that require monitoring, data availability, financial resources available for monitoring, institutional will for monitoring, objectives of the monitoring and other aspects.
- The present study is concerned with collecting data on fisheries production and five types of benefits, but many PICTs will also want to collect data for biological purposes, such as catch per unit effort (CPUE) and length frequency for sustainability purposes. The prioritisation of combined Benefish-type monitoring and biological-type monitoring is beyond the scope of the present study.

In this situation, it seems that the most appropriate way forward is to give considerations that should be taken into account when countries prioritise the collection of fisheries data, rather than prescribing specific types of data to be collected.

Accordingly, the following should be considered:

- In preceding sections of this book, several cases have been made that the collection of production information on coastal fisheries (especially coastal subsistence fisheries) should receive much more attention than in the past. Considering that most of the fish from the region that is consumed in the region comes from coastal fisheries, there is a strong case for giving high priority to collecting production data on coastal fisheries.
- For countries that are unable to afford to have a system dedicated to coastal fisheries, the household income and expenditure survey (HIES) is an alternative that should be considered.
- Few PICTs collect good aquaculture statistics. Because of the amount of resources invested in past aquaculture development, the mixed success of aquaculture development efforts, and that virtually all regional reviews of aquaculture have commented on the poor state of aquaculture statistics, countries need to invest considerable effort to collect, compile and report on the volume and value annual aquaculture production.

- Management interventions in fisheries sometimes results in trade-offs between various groups of people. In countries where this occurs, information on fisher participation in various fisheries could assist in making management decisions – and therefore data on fisheries employment should be collected in countries where these types of management decisions need to be made.
- It should be recognised that that offshore fishery statistics are in relatively good shape, but considerable assistance from the Pacific Community (SPC) over several decades was required to arrive at that favourable situation.
- Attention should be paid to an important aspect of collecting fisheries information: a lesson learned in establishing and supporting coastal fisheries statistical systems over the last four decades is that when donor funding is withdrawn, the financing from national sources that supports the collection of coastal fisheries statistics is highly vulnerable to budget cuts and is often reduced during budget crises. Mechanisms to deter such cuts need to be developed.

How should fisheries data be reported? Ideally, it should be done in a form that overcomes past problems. A surprising large amount of fisheries data sets in PICTs are lost – both before and after analysis. Another common difficulty is other researchers being unaware that such data exist, either because of the passage of time or the researchers being in different institutions. Obviously, having multiple soft copies of the data/reports helps mitigate the problem of lost data (but still the problem persists). Another possibility for reducing these problems is having the report (or a summary report) in the SPC Fisheries Newsletter. Also, there is the option of regularly sending fisheries research reports to the Pacific Collection of the University of the South Pacific Library, where there is considerable security for such reports. A concept that has been promoted in a few countries is requiring a section in the fisheries agency's annual report dedicated to summaries of all fisheries research to have been carried out during the year. This has the added advantage of helping with another common fishery data reporting problem: huge amounts of data being collected but not analysed or reported on.

## 36.2 Recommendations for improving the measurement of fisheries benefits

Recommendations for improving the measurement of the main categories of fisheries benefits have been discussed in several sections of this book. They are summarised in Table 36-1.

**Table 36-1:** Improving the measurement of fisheries benefits

| Benefit category | Suggestions to improve measurement |
|---|---|
| Fisheries production | • In all Pacific Island countries and territories, estimates of offshore fisheries production is relatively good. Considering the importance of coastal fisheries in terms of food and employment, countries and the relevant development partners should be devoting at least as much attention to estimating the production of coastal fisheries.<br>• The new enthusiasm for SPC and donors providing assistance with coastal fisheries statistical systems is commendable and should include attention to some of the difficulties identified in the Emerging Features chapter of this book: (1) inability to expand sampled catches to obtain the total catch of a geographic area, (2) a single tonnage number for fishery production becoming institutionalised and inappropriately used over a long period of time, (3) the utility of "base-line surveys", and (4) overreliance on government statistics offices to know what fisheries-related information should be collected and how to collect it.<br>• The scarcity of aquaculture production data should be recognised and addressed. Long overdue steps to improve the situation should be taken so that progress in aquaculture can be determined, the effectiveness of past aquaculture development efforts can be gauged, and to be able to decide if more spending on aquaculture promotion in the future is justified.<br>• The government fishery agencies of the region should be encouraged to make more use of the HIES in their coastal fisheries work. This could include the agencies (a) proactively becoming more involved in the work of statistics offices in planning for a HIES and (b) making arrangements with the statistics offices for access to the unpublished HIES data relating to fisheries.<br>• With the emergence of the HIES as a fisheries tool and its well-established position within the statistics offices of the region, consideration should be given by SPC (i.e. Fisheries, Aquaculture and Marine Ecosystems [FAME] and Statistics for Development Division [SDD]) to "ground truth" the results of a HIES at a few locations with a fisheries-oriented survey. |
| GDP | • Based on the experience gained in four Benefish studies, two of the most practical ways for the staff of a statistics office to improve the estimates of fishing contribution to GDP are for those staff to: (a) compare the re-estimated fishing contributions in the country sections of this report to the official estimate and evaluate the differences and any need for modification to the methodology; and (b) use the available technical expertise in fisheries when devising methodology, collecting data, making the estimate and reviewing the results. In addition to the government fisheries agencies, such expertise can be found in the regional agencies involved with fisheries, especially the Forum Fisheries Agency (FFA) and SPC.<br>• When using the production approach for estimating fishing contribution to GDP:<br>o Formulate logical fisheries categories that group similar fisheries with similar value-added ratios.<br>o In the absence of specialised economic studies for the concerned country, use the suggested value-added ratios of Appendix 3 of this report.<br>o For estimates of offshore fisheries production, use the Western and Central Pacific Fisheries Commission (WCPFC) national fisheries reports. All Pacific Island countries prepare these for the annual meeting of the WCPFC Scientific Committee (available at www.wcpfc.int). A spreadsheet compiled annually by FFA can place values on the catches.<br>• In the longer term and on the level of regional/international institutions supporting Pacific Island fisheries, consideration should be given to additional work in the areas of value-added ratios, the GDP status of locally based foreign fleets, the distinction between locally based and foreign-based offshore vessels, and formulating satellite accounts for fisheries. This should involve cooperative work between FFA, SPC, regional national account specialists and the Suva-based Pacific Island Financial Technical Assistance Centre.<br>• With respect to the latter agency, PIFTAC should be involved in all regional discussions leading to improved fishing contributions to GDP in order to ensure their institutionalisation. |
| Exports | • Government fisheries agency staff should scrutinize the volumes and values of fishery exports in the official customs department data for erroneous information and omissions. If major errors are detected, there should be close collaboration between the staff of fisheries and customs agencies to identify the causes of the errors and mitigation measures.<br>• The official value of tuna exports should be compared with the values in the FFA publication "Economic and Development Indicators and Statistics", available from the Fisheries Development Section of the Forum Fisheries Agency, Honiara – and any large differences should be reconciled.<br>• For the fisheries agencies that do independent monitoring of exports, the ability to produce accurate/timely export summaries should be evaluated. Where this is deficient, those systems should be improved or abandoned.<br>• The treatment of transshipment of tuna as an export should receive additional attention by FFA to ensure consistency across the region and compatibility with regional guidelines so that tuna export information is meaningful. |

| Benefit category | Suggestions to improve measurement |
|---|---|
| Government revenue | • Where there are large differences in the amount of access fees given by different government agencies within a single country, those differences should be reconciled.<br>• In terms of both good governance and giving due credit to the fisheries sector for any revenue generated, the annual reports of government fisheries agencies should provide a reconciled list of access fees and other government income (e.g. domestic fishing license fees). |
| Employment | • The terminology used in employment studies should be improved:<br>o Considering that the term "household participation in fisheries" is the most common metric for fisheries employment in the region, it should be carefully defined and the use of the improved term promoted across the region.<br>o Because the "number of jobs" is vague and can be misleading, the concept of "full-time equivalent" (FTE) should be used in fisheries employment statistics.<br>o FAME, SDD and FFA should be involved defining and promoting these terms.<br>• In the more general surveys (e.g. census, agriculture census, HIES) fisheries-related employment results are often reported in a lumped category (e.g. agriculture, forestry and fisheries workers), which is not very useful for fisheries purposes (nor for agriculture/forestry purposes). National statistics offices should be encouraged to disaggregate the fisheries results in their surveys.<br>• FFA's tracking of employment in the tuna industry is commendable. Improvements should be made in the areas of using FTEs when citing job numbers (mentioned above) and using company-independent means to verify job numbers.<br>• It is clear that reliance on government statistics offices to know what fisheries-related employment information to collect and how to collect it simply does not work. Considerable technical knowledge of the fisheries sector is required to collect meaningful information. Fisheries agencies should proactively seek involvement with statistics offices in the design of surveys that are intended to obtain useful comparative information on fisheries employment.<br>• Following the lead of FFA successfully tracking the progress in the goal of increasing Pacific Islander employment in the tuna industry, there should be regularly monitoring and quantifying of the movement of women into senior roles in government fishery agencies.<br>• Given the amount of effort that regional organisations have focused on discrete fishery sub-sectors across the region – and the importance of employment to PICTs – FAME should make efforts to collect employment data in its studies of fisheries sub-sectors (aquaculture, sea cucumber, FAD fishing, etc.) using standardised terminology.<br>• FAME should promote the concept that the availability of employment information by fishery could enhance fisheries management decisions. |
| Fish consumption | • In future studies of fish consumption, several terminology/methodological issues should be clarified, including:<br>o What is being measured: (a) food actually consumed or the live weight of the fish that produced the food, and (b) the consumption of just finfish or all aquatic foods.<br>o Awareness that "seafood" can create confusion in countries with a large production from freshwater fisheries.<br>o Whether canned fish is included and whether the quantity in the can (all edible) is being added to whole fish equivalents (not all edible).<br>o Whether imports and exports of fish are considered and how they are included in countries that have unreliable export statistics.<br>• Comparisons between different fish consumption studies should be done cautiously. There is considerable justification for avoiding comparing fish consumption surveys unless the methods used by the studies are known, and they are either the same or corrected so that equal features are being compared. |

## 36.3 Higher-level and longer-term recommendations

In the above table there is a large number of (mainly technical) recommendations to improve the measurement of benefits from fisheries. Because many of the suggestions involve enhanced interaction between fisheries agencies and statistics agencies, a general priority arising from the present study is that mechanisms should be explored on how to encourage the desired cooperation between fishery agencies and statistics offices. In this regard, it should be noted that the 2009 SPC Workshop on Using HIES and Censuses in Fisheries seems to have had a reasonably good impact on cooperation between the fisheries and statistics people who attended. Other perhaps simpler mechanisms include having fisheries presentations at regional statistics meetings and effective distribution of the present report to statistics agencies in the region.

The remarkable drop of per capita production from coastal fisheries over the period 2007–2021 alone (a decrease of 14% over 21 years[1]) should be a "wake-up call" for countries that do not focus much attention on effective coastal fisheries management. Because it is coastal fisheries that provide most of the fisheries-related employment and food in the region, implementing the difficult task of improving coastal fisheries management should be pursued with greater vigour.

The paucity of information on coastal fisheries production is a problem in most countries of the region. If a fisheries agency cannot afford some type of snapshot coastal fisheries survey, consideration should be given to obtaining information from studies outside the fisheries sector: a HIES, agriculture census or national census – but again, the key to assuring relevance of those surveys to fisheries is cooperation with statistics agencies.

In the past, one of the most important tools for learning what was happening in a national fisheries sector was the annual report of the government fisheries agency. These reports provided information useful not only for regional fishery researchers, but also for national fishery stakeholders, other government agencies, the media and the general public. Past efforts by SPC, NZ Aid and the Packard Foundation assisting countries in the timely production of annual reports seems to have been effective – and the impacts have continued after the original interventions. There should be additional assistance by the regional organisations and other development partners to those countries who wish to improve their annual reports.

[1] While it could be argued that the non-coastal population of some of the larger countries in Melanesia could distort this finding, the populations were treated consistently in the 2007, 2016 and present study – so the trend is valid.

Access fees for foreign fishing expanded greatly between 2007 and 2021. In real terms (i.e. inflation adjusted), the access fees for the region increased 475% during the period. Much of this is due to the vessel day scheme increasing fees in those countries that are parties to the Nauru Agreement. Access fees increased in real terms in all Pacific Island countries and territories that license foreign fishing vessels. This is likely to reflect the long-term global increase in the value of tuna. It is obvious that increases in regional tuna catches taken over the last six decades and the associated increases in access fees cannot continue forever. Efforts to diversify the benefits from offshore fisheries, including the areas of GDP (i.e. local basing), exports, employment and food, should receive increased attention, similar to past efforts to expand catches and increase access fees.

In terms of the supply of fish for consumption in the region, a number of studies (including the present report) point to a decline in availability from traditional sources (i.e. coastal fisheries). A number of mechanisms to mitigate this decline have been pursued over the years (e.g. aquaculture, FAD fishing, diversion of fish from offshore fishing) with varying degrees of success. Considering the gravity of the fish shortage problem, the high-level directives on this issue, and how many resources have been invested in attempting to alleviate the situation, there should be an evaluation of the effectiveness of those mechanisms and the likelihood of those and other mechanisms to be successful in the future.

# 37 Concluding Remarks

## 37.1 This study and similar work in the future

Because work similar to that of the four Benefish studies is likely to be undertaken in the future, it may be useful to provide some observations/advice and note some of the lessons learned across the four Benefish studies, which spanned the period 1999–2023. The lessons include:

- The studies are very time sensitive. Although the time frame for preparing, collecting, analysing and writing was tight, the compressed work schedule encouraged production of the study in a timely manner.
- The institutional culture of SPC enabled the production of such a major work within a short schedule. The production of the first two Benefish books were managed by the Asian Development Bank, and the 2009 version suffered a long delay due to the Bank's lack of priority for publishing the book in timely manner.
- Cooperation with SPC's Statistics for Development Division proved extremely valuable in a number of ways, including its liaison with the statistical agencies of the region and assistance in areas where a fisheries specialist lacks expertise.
- The cooperation with other regional organisations involved with fisheries was secured prior to carrying out any work. Sensitive areas were discussed, and satisfactory arrangements were finalised. Cooperation with the FFA's Fisheries Development Division was especially helpful and proved mutually beneficial.
- Commencing work in early August is strategic because tuna catch data and macro-economic data from the previous year begin to become available at that time. Starting the study at that time (rather than a month later) also avoids in-country information collection when senior officers are out of the country in November and early December at a series of offshore fisheries meetings.
- The supervising officers for all four Benefish studies (one person at ADB, two at SPC) had the "right touch": not micro-managing, but available to give support when needed and flexible in accommodating unanticipated events.
- The concept of engaging suitably qualified people to collect information in some countries saved valuable time that could be more efficiently used by the main consultant in analysis and writing.

- As mentioned in the GDP section above, the distinction between locally based and foreign-based offshore vessels is becoming increasingly blurred. This issue – and its interaction with the Benefish methodology – requires additional attention in future studies.

The major difficulty encountered in the latest study concerned travel restrictions due to Covid. At the beginning of the study, much time was expended satisfying various national requirements and making contingency plans for countries to be visited. By the end of the study, almost all Covid-related travel restrictions had been removed.

A number of changes should be made to future Benefish studies, including the following:

- The junior professional Pacific Islander working with the present study worked out well, but in the future, the Benefish study team should include a Pacific Islander with a substantial background in economics.
- For a junior professional Pacific Islander to fully participate in the study, that individual needs to have visas for Australia, New Zealand and the United States in order to pass through those countries to visit some SPC member countries. The amount of time required to obtain those visas should not be underestimated.
- In the 2008 Benefish work, a number of "add-on" studies were included (e.g. fuel use in fisheries) that had little to do with the main goal of quantifying benefits. The lesson is that it would have been better to resist taking on such additional areas and to retain focus on the core areas of fishery benefits. The task of completing a Benefish study in seven months is huge, and extra work adds to the risk of delays.
- For GDP purposes, fish processing is outside of the SNA fishing sector, but this is where much of the "action" in fisheries-related benefits will occur in the future. This indicates the need to develop the conceptual framework for quantifying processing-related benefits – possibly through the development of a "fishing plus fish processing sector", similar to – but much less complex than – a fisheries satellite account.
- Additional work needs to be done prior to the next Benefish study on the appropriate methodology for quantifying and comparing fisheries-related employment. In this regard, the implementation of recommendations on improving the measurement of fisheries employment given in the previous chapter is especially important.
- Virtually all fisheries officers encountered in the present study were familiar with the 2016 Benefish book. Because few of the staff of the national statistics offices had seen the book, extra attention should be given to book distribution to the statistics offices.

## 37.2 Some key points on fisheries production and benefits

This study assessed the 2021 fisheries production of 22 Pacific Island countries and territories in six categories: coastal commercial, coastal subsistence, locally based offshore, foreign-based offshore, freshwater and aquaculture. It is estimated the volume of production in these categories was about 1.56 million t[1], worth about US$2.5 billion.

In the PICT region, the total volume of fishery production in the period between 2007 and 2021 increased by 293,565 t, or 20.3%. Expressed in 2021 prices, in the 22 countries and territories, the combined real value of all six categories of fishery and aquaculture production was about 8.7% less in 2021 than it was in 2007. The lack in increase in value is likely due to several factors, including the decline in the real price of purse seine skipjack in the period between 2007 and 2021, and coastal commercial production suffering a considerable decline during the Covid period. Regarding the latter, Covid had a large impact on fisheries in 2021, the focus year of this study. This issue is further explored in Section 35.8.

The following are some of the more surprising facts to emerge from the present study:

- The total production from the region in 2021 (1,555,579 t) divided by the population of the region in 2021 (12,530,000 people) equates to 124 kg of fish per person. Because the large inland population of PNG distorts this result, the total production of the region (less that of PNG) divided by the population of the region (less that of PNG) equates to 337 kg of fish per person.
- In 2021 the offshore fishery production in the Kiribati zone was the greatest of any PICT: 352,032 t with an in-zone value of US$448,521,818.
- In the present study, the total production by volume from offshore fisheries of the region is almost nine times that of all coastal fisheries combined. By value, it is about 4.4 times greater.
- A total of 88.3% of the value of all aquaculture production in the region in 2021 was produced in two French territories – French Polynesia and New Caledonia.
- Aquaculture production is significant (i.e. gross value annual production worth more than US$50,000) in only 11 of the 22 PICTs.

[1] This does not include aquaculture due to the mixture of production units (tonnes and pieces). For 2021, aquaculture production in the region is estimated to be 7,573 t and 8,825,931 pieces.

- In Fiji, where tilapia culture is considered to be relatively successful (and where there are subsidies), the annual production of food from the aquaculture sector is about 360 grams per person per year.
- About 73% of all tuna processed or handled onshore in 2021 in the PICT region occurred in PNG.
- PNG employs more people in the tuna industry than all the other countries put together.
- The PICTs that have the largest values of fishery exports are American Samoa and PNG. Of the total of about US$1.1 billion of fishery exports from the region in 2021, about 70% is from these two places.
- The total amount of fishery exports from the entire region increased in real value by about 20% over the period 2007–2021. This increase is remarkable considering that 2021 was in the Covid period and sea cucumber harvesting (with its large export value) did not occur in most countries in 2021.
- For the year 2021, offshore fishing access generated a total of US$514,795,325 in revenue for the 22 Pacific Island countries and territories.
- PNG and Kiribati together are responsible for over half of the regional access fees.
- In 2021 access fees for offshore fishing were 26.8% of the in-zone value of the regional offshore catch.
- In the period 2007–2021, access fees increased in real terms in all countries that receive access fees, except Vanuatu and Fiji. The change was greater than 500% in most countries.

## 37.3 Some final thoughts

The original intention of documenting the contribution of fisheries to the economies of Pacific Island countries was to stress the importance of fisheries, a sector whose contribution to national economies was thought to be underestimated. While the series of Benefish books was able to document the importance of fisheries, another aspect arose during the studies: the usefulness of information on the various types of fishery benefits for informing management decisions. In the preceding chapters, examples were given for how data on fisheries employment, fish consumption and aquaculture production could assist in making choices and weighing trade-offs that are required in the fisheries management process. This should be considered when prioritising the types of data to be collected.

One of the most significant findings of the present study concerns coastal fisheries. Considering that coastal fisheries provide the vast majority of fish from the region for consumption by residents of PICTs (i.e. almost all the production from offshore fisheries in the region is shipped out of the region), the annual per capita supply of coastal fish is crucially important. In 2021 this supply was 13.8 kg per capita, a decline of 14% over the period 2007–2021, which is cause for major concern. Improved data on coastal fisheries data should be able to better pin down the causes of this decline and assist in developing efforts to address it.

# Appendix 1: Executive Summaries of Benefish Studies

## The 2001 Gillett and Lightfoot Benefish study

The Gillett and Lightfoot (2001) study focused on the year 1999. The main findings, conclusions and recommendations of the study are summarised below.

### Official data on the contribution of fishing to gross domestic product (GDP)

According to official data for Pacific Island countries, the contribution of fishing to GDP in 1999 (or latest prior year available) ranged from 0.6% in Papua New Guinea (PNG) to 12.0% in Kiribati.

### Re-estimation of the fishing contribution of fishing to GDP

Given the complexity of the issues to be addressed and large variations in the accuracy of official fishing estimates made in the Pacific Island countries, it was important for the study to re-estimate the fishing contribution to GDP using a consistent method across all countries. It was believed that, at the very least, these estimates would provide useful comparators for the compilers of national accounts. In addition, it was anticipated that the review of the different methods and approaches used in each country would provide useful insights into the effectiveness of alternative approaches to national accounting.

### Comparison of official and re-estimates

A comparison between the official and new estimates of fishing contribution to GDP is presented in Figure A1-1, below. The largest differences were found in Kiribati, Palau and Federated States of Micronesia (FSM), where the new estimates nearly doubled or tripled the official figures. In contrast, this study lowered the estimate of fishing contribution to GDP in the Marshall Islands, Samoa and to a lesser extent, the Cook Islands. On average, the new estimates indicated a higher contribution of fishing to GDP than reported by national statistics (7.0% vs 5.4% across all countries).

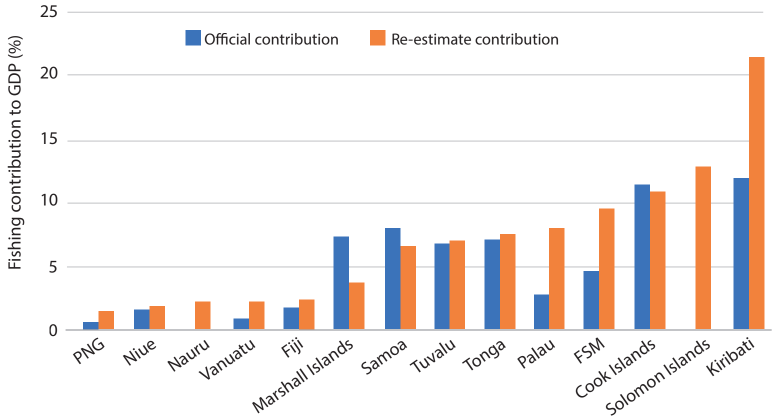



**Figure A1-1:** Comparison of official and new estimates of fishing contribution to the gross domestic product of Pacific Island countries

## Major reasons for differences in estimates of fishing contribution

In some countries, notably FSM and PNG, the difference in estimates is primarily due to subsistence fishing not being included in the official figures. In other countries, in particular Palau, the differences are primarily due to the methods used. For most countries, it is a combination of differences in the estimate of production and the method used to calculate the GDP contribution. In Samoa, for example, subsistence production was valued at the full market value, rather than at "farm gate" prices. The Cook Islands, Niue, Tonga and Tuvalu all compile soundly based national accounts that include reasonable estimates of fishing contribution. Nauru and the Solomon Islands have weaknesses in compiling national accounts.

## Common difficulties associated with calculating the contribution of fishing to GDP

Common difficulties in estimating the contribution of fishing to GDP in many Pacific Island countries include the following:

- Fisheries technical input. There is a lack of coordination between fisheries agencies and statistical agencies in the calculation of fishing input.
- Treatment of subsistence fisheries. There is often a lack of data on subsistence fisheries and difficulties in isolating fishing from other subsistence activities.

- Fish processing. The System of National Accounts (SNA) scheme classifies the processing of fish outside the "fishing" sector, and thus it is often not possible to isolate the contribution of this important fishing-related activity from other forms of food processing.
- Export data. Official export figures in Pacific Island countries characteristically undervalue exported commodities, especially fisheries products.
- Economics of small-scale fisheries. Data on small-scale fisheries are often scarce, as is technical assistance for its analysis.
- Lack of "champions". There is often a scarcity of individuals in Pacific Island countries who are vocal at stressing the importance of the fisheries sector, which contributes to its undervaluation in national statistics.

## Fishery production in specific Pacific Island countries

Figures A1-2 and A1-3 show the estimated fisheries production and annual value in Pacific Island countries.

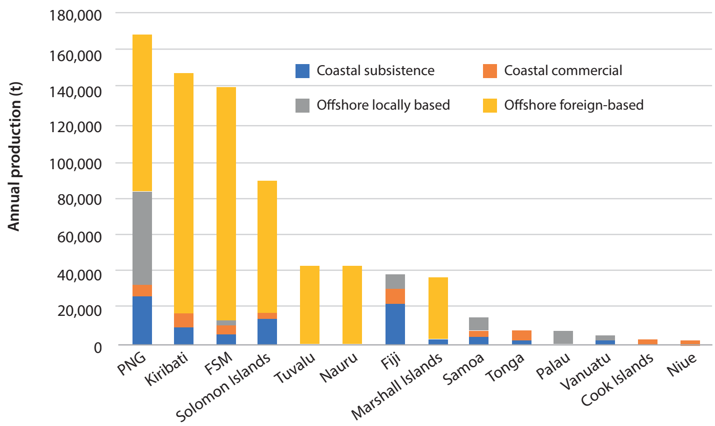



**Figure A1-2:** Estimated annual fisheries production of Pacific Island countries by volume, late 1990s

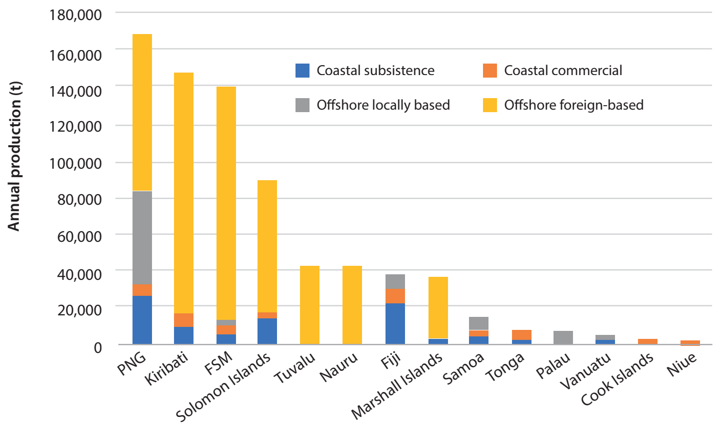



**Figure A1-3:** Estimated annual fisheries production of Pacific Island countries by value, late 1990s

## Fishery production patterns

Key patterns in the fisheries production data include:

- The weighted average price per kg in the region is US$1.04 for subsistence fisheries, US$2.41 for coastal commercial fisheries, US$1.28 for locally based offshore fisheries and US$1.04 for foreign-based offshore fisheries.
- The ranking of countries by total fisheries production is strongly influenced by the level of tuna catches.
- Going from west to east across the region and from equatorial to higher latitudes, there is a general pattern of total national catches decreasing.
- The higher value of longline tuna relative to purse seine tuna is apparent from the ranking of FSM, where a relatively large proportion of the catch is taken by longline vessels. FSM ranks third by volume and first by value.
- Fiji appears to have the largest non-tuna production in terms of both volume and value.
- The production from Nauru and Tuvalu is almost entirely related to tuna fishing.

## Fisheries-related employment

There are also certain observations that can be made about employment in the fisheries sector, as follows:

- The importance of fisheries in the subsistence economy seems to be strongly linked to the type of island. In decreasing importance, atolls, islands and large high islands are associated with very different levels of significance. This pattern is somewhat altered by PNG with its important freshwater subsistence fisheries.

- The importance of formal employment in fisheries seems to be related more to business conditions than to island type. Most formal employment in fisheries appears to be tuna related.
- The importance of women's employment in fisheries is generally understated due to the practice of classifying activity according to a person's "main unpaid activity", which masks the importance of secondary activities. For many women, childcare is often the "main unpaid activity", so any fishing activity, even if it is a substantial amount of activity, is not duly reported. Additionally, commercial fish processing (where many women are employed) is placed in the manufacturing sector.

Where commercial fish processing occurs (canning, loining), and when this is attributed to the fisheries sector, the increase in fisheries-related employment is remarkable.

## Fishery exports

The most notable feature of fishery trade data in the Pacific Islands is the underestimation of the value of fishery exports. This underestimation appears large and is probably worse than in other trade sectors. In most cases, when the official export values are compared to other sources of similar information, the differences are remarkable. Figure A1-4 provides estimates of fisheries exports for the late 1990s.

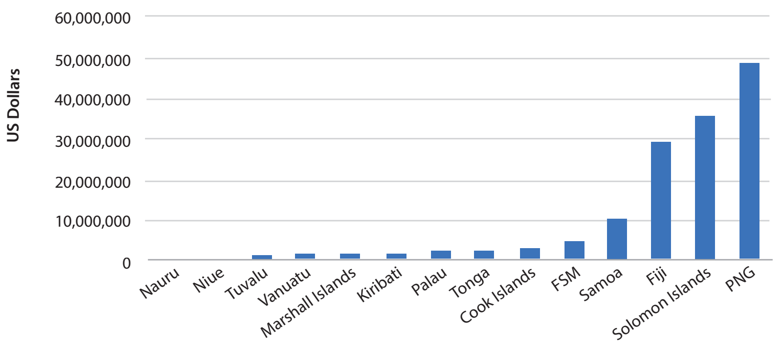



**Figure A1-4:** Estimated values of fisheries exports of Pacific Island countries, late 1990s

## Features of the fishery import and export data

Some of the key features of fisheries trade in the region include the following:

- In general terms, the region exports tuna and other high-value species such as trochus and beche-de-mer, while importing canned and inexpensive frozen fish.
- Tuna products dominate the fishery exports of the region. For the five main exporting countries, tuna (fresh, frozen and processed) overshadows all other fishery exports.
- Canned mackerel dominates fishery imports.
- The relatively new aquarium fish industry is responsible for a significant portion of fishery exports. Aquarium fish exports from Kiribati and the Marshall Islands now account for 78% and 95% of all fishery exports from those countries, respectively.
- There is considerable interannual variation in fishery exports.
- The amount of fishery products exported as passenger baggage is quite large, especially in the Marshall Islands, FSM, Palau and Samoa.

## Access fees

All Pacific Island countries received fees for foreign fishing activity in their waters. In some countries, the access fees form a very large portion of government revenue. In FSM for example, the 1999 access fees represented an estimated 39% of non-tax revenue and 22% of total domestic revenue. In Kiribati, 34% of government income in 1999 was derived from fishing license fees. Figure A1-5 summarises the value of access fees received by the different Pacific Island countries in 1999.

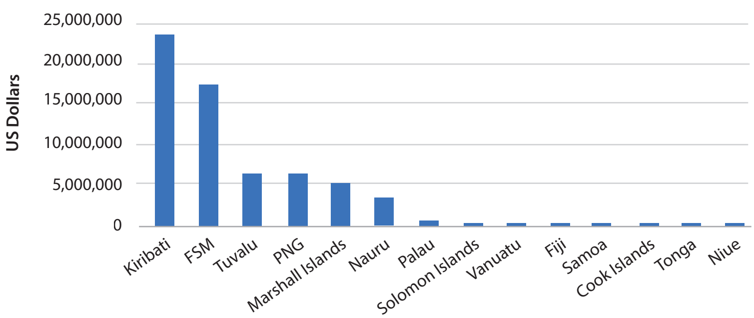



**Figure A1-5:** Estimated access fees from foreign fishing vessels, 1999

## Fish consumption

Key features of fishery product consumption in the region include the following:

- In general, countries made up of predominantly small islands have high fish consumption rates, while large island countries have low consumption rates. The exceptions to this are Tonga, where the data suggest surprisingly low fish consumption rates, and Palau, where fish consumption is remarkably high.
- Most of the Pacific Island countries exceed by a large margin the world average per capita fishery product consumption rate of 13.0 kg.
- Most estimates for Kiribati indicate that it has the highest rate of fish consumption in the world.

The estimates of per capita consumption are summarised in Figure A1-6.

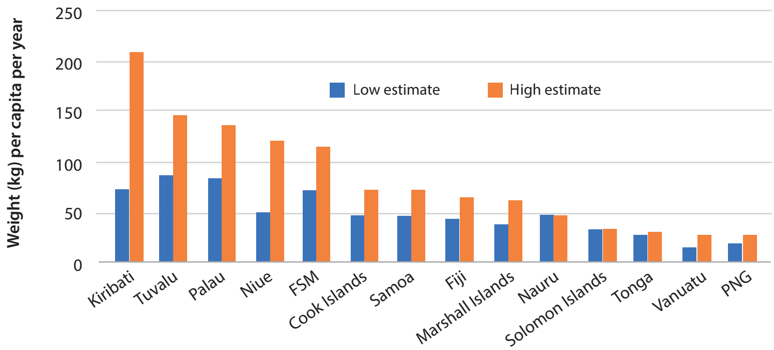



**Figure A1-6:** Ranges in annual per capita fisheries consumption for Pacific Island countries in the 1990s

## Main conclusions

An important conclusion of this study is that fisheries contribution to GDP is underestimated in most Pacific Island countries.

In countries where estimates of fishing contribution to GDP are markedly different from estimates made in this study, the process used in preparing the national accounts tends to rely on dated surveys, weak indicators and/or poorly understood methods. It is recommended that in these countries, the compilers of national accounts carefully examine and evaluate the data, assumptions and methods used.

The accuracy of estimates of fishing contribution to GDP could be improved by closer cooperation between fisheries and statistics agencies. The fisheries agencies are in a position to provide information on new developments, technical insight and recent data, all of which could improve GDP estimates. This collaboration, however, rarely occurs in Pacific Island countries. Because the fisheries agencies have a vested interest in assuring that the importance of their sector is not underestimated, they should take the lead in improving the liaison with the compilers of national accounts.

One of the factors that often result in an underestimation of fisheries contribution to national economies is the limited information available on the production of small-scale fisheries. Throughout most of the region, the statistics on small-scale fisheries are incomplete, inaccurate and in some cases, absent. Given this reality, it is recommended that maximum use be made of survey opportunities outside the fisheries sector. At little cost, production information on small-scale fisheries could be collected through such tools as the national census, nutrition surveys, agriculture censuses, household income and expenditure surveys (HIES) and poverty studies.

In many countries, the underestimation of the value of fisheries exports in official customs statistics is a major source of error in the calculation of fisheries contribution to national economies. It appears that export information could be worse in fisheries than in most other sectors. In countries where this problem is especially acute, it is recommended that export valuation be based on a broader spectrum of information than what is provided by customs.

Additional information on the economics of small-scale fisheries would contribute to improving measurement of the fisheries contribution to GDP. Studies to gather the required data need not be complex but should cover the major small-scale commercial and subsistence fisheries.

Where the compilers of national accounts have access to comprehensive and detailed information on the income/expenditure of the participants in one or more sectors of the fishing industry, the income approach is the most appropriate method. In the Pacific, however, it is rare for this data to be available. In these circumstances, the production approach is likely to generate the most accurate results.

Regional organisations could play an important role in improving the measurement of fisheries in the economies of their member countries.

## The Gillett (2009a) study

The Gillett (2009a) study focused on the year 2007. The main findings, conclusions and recommendations of the study are summarised below.

### The study

In 2008 discussions between the Asian Development Bank, Secretariat of the Pacific Community, Forum Fisheries Agency and Australian Agency for International Development resulted in an agreement for an update and expansion of the Gillett and Lightfoot (2001) study. It was agreed that the scope would be expanded to include additional topics, including the production from aquaculture and freshwater fisheries, and some important factors that are likely to affect the flow of benefits from fisheries in the future. It was also decided to include the non-independent Pacific Island territories,

### The contents

The book contains a fisheries-oriented discussion of macroeconomics, country information on specific topics (fisheries production, contribution to GDP, etc.), discussion of important topics across all countries (e.g. the regional significance of access and exports of fishery products), some important features of the benefits from fisheries that emerged from this study, and some major factors that influence the flow of benefits from fisheries.

### GDP, fishing and fisheries

Background information on estimating gross domestic product is provided, along with guidelines on estimating the fishing contribution to GDP.

An important point is that for national accounting purposes, the sector is "fishing", rather than the more inclusive "fisheries". Post-harvest activities, including fish processing, are not included in the fishing sector when estimating GDP.

### Country data on fisheries benefits

Information on benefits from fisheries is provided for each of the 22 Pacific Island countries and territories. These country and territory chapters contain recent, readily available data for the following areas:

- Recent annual fishery harvests: values and volumes covering the six fishery production categories, which are (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing and (6) aquaculture.

- Fishing contribution to GDP: the current fishing contribution, how it was calculated, and a local production approach re-calculation based on annual harvest levels obtained during the study.
- Fishery exports: amounts, types and the ratio to all exports.
- Government revenue from the fisheries sector: access fees and other revenue.
- Fisheries-related employment.
- Fisheries contribution to nutrition.

## Regional fisheries and aquaculture production information

The total volume of fisheries production in the region in 2007 is estimated to be 1,327,361 tonnes (t), plus an aquaculture production of 2,984 t and 305,336 pieces. The total value of fisheries and aquaculture production in 2007 is estimated to be approximately US$2.05 billion.

Offshore foreign-based fishing is responsible for about half the value of fisheries in the region, offshore locally based about a quarter, and for the remaining quarter, about equal shares of coastal commercial, coastal subsistence and aquaculture.

With respect to changes in fishery production between 1999 and 2007, there was a remarkable increase in PNG and moderate increase in most other countries. By category of fishing, there were substantial production increases for offshore fisheries, whereas coastal fishery production levels showed no overall change.

The estimated value in each country of the six fishing categories (coastal commercial fishing, coastal subsistence fishing, locally based offshore fishing, foreign-based offshore fishing, freshwater fishing and aquaculture) appears in Table A1-1 below:

**Table A1-1:** Value of fisheries and aquaculture production, 2007

| Country | Total value (US$) | Country | Total value (US$) |
|---|---|---|---|
| PNG | 812,067,902 | Vanuatu | 34,397,887 |
| Kiribati | 244,185,828 | Palau | 24,139,152 |
| FSM | 224,483,967 | Tonga | 20,571,101 |
| Solomon Islands | 202,003,233 | American Samoa | 14,793,083 |
| French Polynesia | 188,656,724 | Cook Islands | 10,323,529 |
| Marshall Islands | 108,125,102 | Wallis & Futuna | 7,540,230 |
| Fiji | 103,420,625 | Niue | 2,520,588 |
| Nauru | 81,518,168 | Northern Marianas | 1,786,700 |
| New Caledonia | 49,663,126 | Guam | 1,370,000 |
| Tuvalu | 43,773,582 | Tokelau | 1,108,812 |
| Samoa | 42,939,982 | Pitcairn Islands | 74,265 |

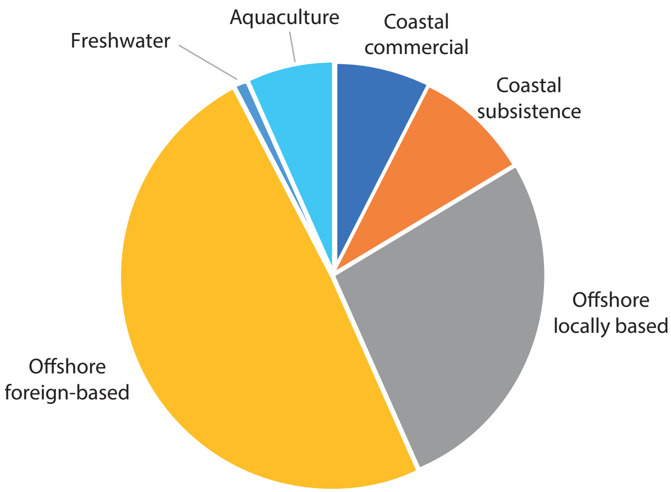



**Figure A1-7:** Relative value of fisheries production by sub-sector

### *Aquaculture production*

If the aquaculture production from three atypical countries in the region is eliminated from consideration, significant aquaculture production comes from a limited range of activities: large-scale private sector pearl culture and shrimp culture where there is a significant tourist trade. There is significant tilapia/milkfish and giant clam culture, but whether net benefits are produced depends on the degree of subsidisation, a situation that is often not clear.

### *Measuring the production of small-scale fisheries*

In most countries, there is an extremely weak factual basis for estimates of coastal commercial and coastal subsistence catches. There seem to be three types of situations, however, where good estimates are available, as follows:

- Countries that have a dedicated ongoing national fisheries statistical system supported for many years by an overseas agency.
- Countries that have carried out an intensive, well-planned survey of fisheries to obtain an accurate snapshot.
- Countries that use a HIES for small-scale fisheries production purposes.

## GDP estimates

For each country, the official fishery contributions to GDP are given along with the relative importance to the economy. In addition, a re-estimation is provided for the fishing contribution to GDP in each country. It is not intended that the re-estimate replace the official methodology, but rather that the results obtained serve as a comparator to gain additional information about the appropriateness and accuracy of the official methodology and to indicate any need for its modification.

In most locations, the re-estimate is larger than the official figure. In two locations, the re-estimate was substantially smaller. On the basis of a good knowledge of the fisheries sector, the results in those two countries are likely to be erroneous.

### *Fishing contribution to GDP: 1999 vs present study*

Changes in fishing contributions to GDP were greatest in the Marshall Islands (with the establishment of a locally based offshore fleet) and PNG (with increased activity of the locally based offshore fleet). Fishing contributions to GDP decreased the most in the Cook Islands (with the decrease in production from pearl farming) and Nauru (with the termination of locally based offshore fishing and a decrease in coastal commercial fishing). At least some of the observed changes were due to improved estimates of various categories of fishing.

### *Improving the official GDP estimate*

General improvements to estimating GDP are far beyond the scope of this project. However, there are some simple and obvious ways for improving the accuracy of estimating the fishing contribution to GDP. The most important are that statistics staff should: (1) obtain technical fisheries expertise when devising methodology, collecting data, making the estimate and reviewing the results; and (2) compare the official estimate to the re-estimate of the fishing contribution given in the country and territory chapters of this book and evaluate the differences and any need for modification to the methodology.

## Fishery exports

Fishery exports are very important to the countries of the region. In about half of the countries, fishery exports represent over half of all exports. Where they represent less than half the value of national exports, they are mostly quite large in nominal terms: New Caledonia (US$157 million), PNG (US$101 million), Fiji (US$63 million) and the Marshall Islands (US$37 million). The three entities that have the largest value of exports are American Samoa, New Caledonia and French Polynesia. Of the total of about US$996 million in fishery exports in the region in 2007, about three quarters are from these three territories.

In terms of export commodities, by far the most important in value are the tuna products. The tuna exports from American Samoa alone approach the value of all the fishery exports in all other Pacific Island countries combined.

In nominal terms, the value of fisheries exports of the region almost doubled in the period 1999–2007. Fishery exports have increased relative to total exports in most countries but have fallen significantly in the Solomon Islands and Samoa.

## Foreign fishing access fees

Access fees received by Pacific Island countries are provided and compared to total government revenue, population and value of the catch. Total access fees received in 2007 were US$78.5 million, an increase of about 25% since 1999.

## Fisheries-related employment

The national fisheries-related employment information in the country and territory chapters is very much a mixed jumble of facts. Nevertheless, an attempt is made to extract information that best characterises the national fisheries-related employment situation. For each country of the region, the best available information is provided on the relative importance of (1) employment in commercial fisheries and (2) involvement in subsistence fishing.

Two important features of the data are: (1) The importance of participation in subsistence fisheries seems to have a strong relationship to the type of island. The level of importance is highest in atolls, followed by small islands and is least in large high islands; and (2) the importance of fisheries in formal employment seems to be related more to business conditions than to island type. These conditions include, among others, proximity to processing facilities and airline connections to fresh fish markets.

### Participation of women in fisheries

Due to efforts over the past 15 years at the national and regional levels, much more is now known about women's fisheries activities in the Pacific Islands. Presently, the main difficulties that affect the accurate portrayal of the importance of women in fisheries-related employment appears to be: (1) the concept of using "main unpaid activity" in surveys for defining the subsistence fisheries sector as it downplays the importance of secondary activities (e.g. even for women who do considerable fishing, childcare is often the main unpaid activity), and (2) placing commercial fish processing in some countries (where many women are employed) in the manufacturing sector.

### Fish consumption

The readily available information on the consumption of fish and other fishery resources is compiled and compared. Some of the past comparisons between fish consumption surveys and between countries may be inappropriate due to methodological differences. The main difficulty is that most studies on fish consumption in the region determine one of two kinds of consumption: either the amount of food actually ingested, or the whole weight of the fish that produces the food. Comparing fish consumption surveys should be avoided unless the methods used by the studies are known, and they are either the same or corrected so that equal features are being compared.

### Fishery benefits by zone

The fishery categories used in this book (coastal commercial, locally based offshore, etc.) could be re-arranged slightly to represent ecological zones. In partitioning benefits by those zones, some interesting patterns emerge. A large part of the benefits from employment and nutrition – things that directly affect Pacific Islanders – comes from the coastal zone. The less tangible and more abstract benefits (contribution to GDP, exports and government revenue) tend to come disproportionately from the offshore area.

## The household income and expenditure survey

Most Pacific Island countries have had a HIES, and all of the independent Pacific Island countries and several of the territories were planning for a HIES. A HIES may be a good opportunity to improve the measurement of small-scale fisheries but on the other hand, some significant problems are apparent in the use of HIES for fishery purposes. A common feature in many countries is that the coastal fisheries production estimated by a HIES is relatively low. The way forward appears to be for fisheries specialists to cooperate with HIES specialists on an initiative for improving the applicability of the HIES to the fisheries sector.

## A satellite account for fisheries

By international convention, the "fishing" sector for GDP purposes does not include post-harvest activities, which are quite important in many Pacific Island countries and are likely to become more important in the future. To rectify this problem, a "satellite account" can be constructed. Groups and sub-groups of industries can be identified and aggregated to form a satellite account that, in the case of fisheries, would include post-harvest activities. As an example, a simple first order satellite account was constructed for Fiji's fisheries sector. It showed that the F$104,375,000 estimated for the broad fisheries sector in the satellite account is about 34% greater than the F$77.8 million estimated for the narrow fishing sector. If Fiji's total GDP in 2003 was F$4,390,551,000, then the contribution to GDP increases from 1.8% for the fishing sector to 2.3% for the fisheries sector.

## Climate change

A preliminary assessment of the effects of climate change on fisheries and aquaculture in the Pacific Island region is given. It outlines how the climate of the Pacific is projected to change, how climate change has affected fisheries elsewhere in the world, and how it is expected to affect fisheries and aquaculture in the Pacific.

## Fuel costs

The results of a complementary study on energy costs and fishing in the region are provided. This is an assessment of the direct impact of fuel price fluctuations on the financial performance of ongoing fishing operations of domestic fishing fleets in Pacific Island countries.

## Changes 1999 to 2007

An earlier study covered the independent countries of the region and focused on the year 1999. It produced some results that can be compared to this study, as follows:

- During the period 1999–2007, the relative contributions to GDP (i.e. ratio of fishing contribution to total GDP) increased in 11 countries and decreased in three.
- In nominal terms, fisheries exports of the region almost doubled in the period 1999–2007. Fishery exports increased relative to total exports in most countries but fell significantly in the Solomon Islands and Samoa.
- Foreign fishing access fees increased in nominal terms for all but three countries, with an overall regional increase of almost one quarter (US$18.7 million) in the seven-year period between the studies.
- The first two points indicate a larger role of fisheries in the economies of most Pacific Island countries. As to the third point, real gains were moderated by granting access fee concessions to encourage local basing (i.e. other types of benefits through domestic industry development).

## The main recommendations of the study

### *Coastal resources: Reaching the limits*

For the region as a whole, offshore fisheries are expanding substantially, while there is no overall production increase from coastal fisheries. Limited fishery production expansion in the coastal zone equates to a non-increasing amount of food and employment being spread among a growing number of people. A major implication is that the government fisheries agencies of the region – many of which are oriented to developing coastal fishery potential – may require a fundamental re-orientation to include a strong emphasis on safeguarding the existing levels of food and jobs from the coastal zone.

## Subsidies: Hidden costs of benefits

Discussions of subsidies are not common in the fisheries and aquaculture literature of the region. Exploration of the subject could result in any subsidies being more effectively applied or point to more effective uses of public funds.

## Estimating the production from coastal fisheries: The big unknown

Estimating the production from coastal fisheries in about half of the Pacific Island countries is largely based on "educated" guesswork. In very few Pacific Island countries are the levels of coastal catches well known. Protection of village food fish supplies is arguably the most important objective of the management of coastal fisheries in the Pacific Islands, but to know if such management efforts are effective overall, some idea of the gross coastal fisheries production and any change is required. In terms of government priorities, it seems that a lack of production information tends to lead to lack of attention. Because these are the fisheries that have the greatest direct effect on the lives of Pacific Islanders, determining production levels of coastal fisheries deserves more attention.

## Aquaculture: Improving the track record

In this book, observations and comments on the past performance of the aquaculture sub-sector should not be taken to indicate that aquaculture has no potential in the region. On the contrary, given worldwide trends, it is likely that the contribution of aquaculture to the economies will increase. During the study, a close examination of the net benefits of aquaculture in each Pacific Island country resulted in considerable reflection on the subject of success and failures in the development of aquaculture in the region. Two suggestions for improvement (applicable to both the national and regional levels) can be offered:

- The development models being pursued should be constantly evaluated for effectiveness, especially in cases where the model has resulted in limited success over many years.
- There should be periodic objective analysis of net benefits and potential of aquaculture development initiatives.

## Access fees: Getting to know the unknown

In the 2001 study of fisheries benefits in the region, there was considerable secrecy surrounding levels of access fee payments, even at the aggregate national level, and much of the data on access fee payments in that study was estimated with considerable difficulty. For this study, information on access fee receipts was available in the public domain for most countries. Where this was not the situation, fisheries and/or finance officials cooperated to furnish the information. This change appears to be in accordance with the "Vava'u Declaration on Pacific Fisheries Resources", issued at the Thirty-Eighth Pacific Islands Forum held in October 2007, which stresses the importance of transparency in fisheries licensing arrangements.

### Economic analysis: Assuring objectivity

In terms of economic analysis of benefits from the fisheries sector, observations during the fieldwork led to two general suggestions for improvement, as follows:

- In the analysis of benefits from specific fisheries sub-sectors, efforts should be taken to assure that the analytical work is completely independent of individuals involved in promoting that sub-sector.
- Schemes that subsidise various aspects of fisheries should be regularly analysed – by individuals external to the subsidy programme – to determine whether the objectives of the subsidisation are being achieved, whether there is a favourable cost-benefit ratio for the subsidy, and whether alternative mechanisms could be more appropriate or effective than the subsidy.

#### *Promoting the fisheries sector: Where are the champions?*

Measuring the fisheries contribution to the economies of Pacific Island countries could be improved markedly with closer cooperation between fisheries and statistics agencies. The fisheries agencies are in a position to provide information on new developments, technical insights and recent data, all of which could improve the measurement of fisheries benefits. This collaboration, however, rarely occurs in the Pacific Island countries.

## The 2016 Gillett Benefish study

### The study

In 2001 and 2008 the ADB undertook studies to quantify benefits from the fisheries sectors of Pacific Island countries. In February 2014, discussions between SPC and the Australian Department of Foreign Affairs and Trade resulted in an agreement to sponsor an update of the earlier publications. A consultant was retained, and the fieldwork to collect information began in early August 2014 and was completed in early November. Country-specific information was assembled, analysed and written up from mid-November to late January, and the main text of the book was produced in early 2016.

## The contents

The book contains a fisheries-oriented discussion of macroeconomics, country information on specific topics (fisheries production, contribution to GDP, etc.), a discussion of important topics across all countries (e.g. the regional significance of fisheries access fees and exports of fishery products), some important features of the benefits from fisheries that have emerged from this study, and recommendations on improving the measurement of fisheries benefits and assuring the continuity of those benefits.

## GDP, fishing and fisheries

Background information on estimating GDP is provided, along with guidelines on estimating the contribution of fishing to GDP.

For national accounting purposes, the sector is referred to as "fishing", rather than the broader "fisheries". Post-harvest activities, including fish processing, are not included in the fishing sector when estimating GDP.

## Country data on benefits of fisheries

Information on the benefits of fisheries is provided for each of the 22 Pacific Island countries and territories (PICTs). These country and territory chapters contain recent, readily available data in the following areas:

- Recent annual fishery harvests: values and volumes covering the six fishery production categories, which are (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing and (6) aquaculture.
- Fishing contribution to GDP: the current fishing contribution, how it was calculated, and re-calculation based on annual harvest levels obtained during the study.
- Fishery exports: amounts, types and the ratio to all exports.
- Government revenue from the fisheries sector: access fees and other revenue.
- Fisheries-related employment.
- The contribution of fisheries to nutrition.

## Regional fisheries and aquaculture production information

It is estimated the volume of all fisheries and aquaculture production in the region in the six fisheries categories in 2014 was about 2.0 million t, worth US$3.2 billion.

In comparing these figures to estimates by other studies, it is important to consider carefully how the "region" is defined, and where in the value chain the value is estimated. This study defines the region as the 22 Pacific Island countries and territories and their 200-mile zones. The values used reflect the prices paid to the producer or (for offshore fisheries) in-zone prices.

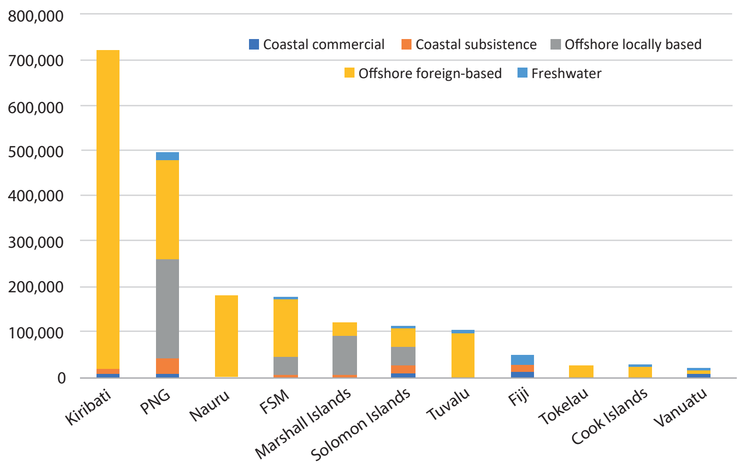



**Figure A1-8:** Volume of fishery production in 2014 in the higher-producing countries (t)

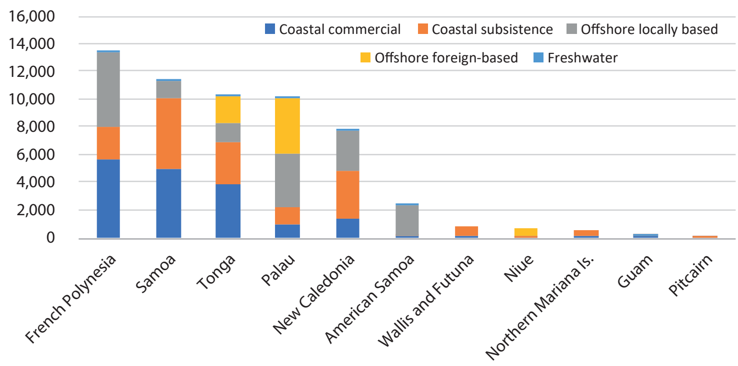



**Figure A1-9:** Volume of fishery production in 2014 in the lower-producing countries (t)

### *Key features of coastal fisheries production*

The following are some of the key features of coastal fisheries production:

- The volume for all coastal fisheries (i.e. commercial and subsistence) in PNG is about one third of the regional total.
- The production from Fiji's coastal commercial fisheries is greater than that of any other PICT, even for that of PNG, with a population almost nine times greater than Fiji's.
- Considering the level of overall development of Samoa and Tonga, the degree of commercialisation of the coastal fisheries (reflected in their relative positions on the comparison graph) is high.
- Considering that New Caledonia and American Samoa are quite developed, the degree of commercialisation of their respective coastal fisheries (reflected in their relative positions on the comparison graph) is relatively low.

### *Key features of offshore fisheries production*

The following are some of the key features of offshore fisheries production:

- The value of offshore fishing in the Kiribati zone in 2014 (US$1.1 billion) approaches the combined value of offshore fishing of all other PICTs, excluding PNG (US$1.3 billion).
- The effects of the 2014 El Niño conditions on offshore fisheries production are readily apparent and have resulted in higher catches in the central equatorial region.
- Three countries in an area of relatively productive tuna fishing had no locally based offshore fishery production (Nauru, Tuvalu and Tokelau). Kiribati had only a tiny amount of locally based offshore fishery production.
- In about one third of the countries that are significantly involved in offshore fisheries, the fleet is entirely locally based. In another third of countries, the fleets are a mixture of locally and foreign-based, while the remainder have foreign-based fleets.
- Although Palau is a party to the Nauru Agreement (PNA), the production from its offshore fishing is less than that of several non-PNA countries.

### *Aquaculture production in the region*

In 2014 aquaculture production in the region is estimated to have been 4,217 t and 9,122,169 pieces, worth US$116,005,524. Two French territories were responsible for more than 93% of the value of all aquaculture production in the region. In only six PICTs was the value of aquaculture production in 2014 greater that 5% of the value of coastal fisheries. All but one of those PICTs (Cook Islands) are territories.

### *Changes in fisheries and aquaculture production during the period 2007–2014*

The following are some of the significant changes in in fisheries and aquaculture production during the period 2007–2014:

- In the 22 countries and territories, the total volume of fishery production increased by 431,354 t (32%).
- The value of fishery and aquaculture production increased by $738,662,323 (30.7%).
- In relative terms, the share of offshore foreign-based fishing expanded, largely at the expense of offshore locally based fishing.
- Coastal fisheries production has been largely stable, despite an increased coastal fishing effort in most PICTs in the region.
- Aquaculture decreased in value by 32.7% across the region. This was mostly attributable to the fall in the value of pearl production in the Cook Islands and French Polynesia.

### *Some issues in measuring fisheries production in the region*

The offshore fisheries statistical systems are in relatively good condition, both at a national and regional level, but the situation for coastal fisheries statistics is not nearly as good. Typically, national government fisheries agencies give a low priority to estimating the total amount of coastal catches. In some respects, this situation is a tragedy. The importance of food security and the roles played by coastal fisheries are beyond dispute, but in order to effectively safeguard the flow of food from coastal fisheries, that flow needs to be quantified: "You can manage what you can measure". In view of the poor statistics on coastal fisheries production in most countries and territories in the region, and the potential for the HIES to improve the situation, the applicability of the HIES to coastal fisheries deserves more attention.

## Household income and expenditure survey

The HIES has the appeal of being capable of providing information about fisheries production with little or no expense to fisheries agencies. In the past, a drawback has been that there were doubts about the accuracy of the HIES in making annual coastal fisheries production estimates. The FSM chapter of this book indicates promising results using the new "fisheries-friendly" HIES (which is discussed further in Chapter 29). This should serve to encourage fisheries departments in the region to make more use of the HIES in their coastal fisheries work.

## Contribution of fishing to GDP

In the country and territory chapters of this book, the official GDP and official fishing contribution to GDP are presented. Methods used in the official calculation of the fishing contribution to GDP are also presented, and some comments are made about the suitability of those methods. For each country, the consultant re-estimated the fishing contribution to GDP using a standard methodology. In many cases, the re-estimation varies substantially from the official contribution. Some possible reasons for the differences are discussed.

### *Improving the estimates of fishing contribution to GDP*

Several technical suggestions are made for improving the estimates of the fishing contribution to GDP. In the longer term – on the level of the institutions supporting Pacific Island fisheries – some assistance is identified that would be of considerable value in the interface between the fishing sector and national accounts. It is suggested that three issues should be addressed: 1) value-added ratios, 2) the GDP status of locally based foreign fleets and 3) formulating satellite accounts for fisheries in each country.

## Exports of fishery products

The annual value of fishery exports in 2014 is given for each country in absolute terms and relative to all exports. The findings show that while fishery exports represent less than 40% of the value of all national exports, in some countries they are quite large in nominal terms, for example: PNG (US$136 million), Fiji (US$58 million), Solomon Islands (US$54 million) and New Caledonia (US$22 million). American Samoa, PNG and French Polynesia have the largest value of fishery exports (the former and the latter being territories). Of the approximately US$820 million in total fishery exports from the region in 2014, about 76% is represented by these three PICTs. Over the period 2007–2014, the total amount of fishery exports from the region fell by about 42% in real (inflation-adjusted) value. The fall in the value of canned tuna exports from American Samoa was responsible for about 37% of the total regional decline. Of the major exporting countries, only PNG and the Solomon Islands increased their fishery exports in the period.

## Access fees for foreign fishing

In each of the country and territory chapters of this book, information is provided on access fees received for foreign fishing, and these fees are compared with total national government revenue. In 2014 foreign fishing access generated US$349,335,572 across all 22 Pacific Island countries and territories. Given the lack of authorised foreign fishing in most territories, the US$349.3 million represents access fees generated in the independent Pacific Island countries as well as Tokelau (Figure A1-9).

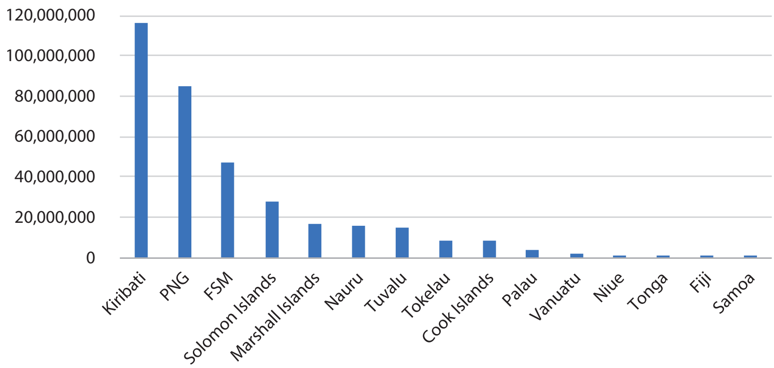



**Figure A1-10:** Access fees for foreign fishing in 2014 (US$)

### *Other aspects of access fees*

The following are some further key points about access fees:

- Four countries in the region received access fees in 2014 representing more than US$1,000 per capita.
- Kiribati, despite having one of the largest 200-mile zones in the region, had a relatively high ratio of access fees per square kilometre of zone in 2014.
- In the period 2007–2014, access fees increased in all countries that received them.
- The countries with the largest increases in access fees were those that participate in the PNA vessel day scheme (in which foreign purse seine vessels purchase fishing days from PNA countries).
- In real terms (i.e. adjusted for inflation), the region has experienced an eight-fold (848%) increase in the value of access fees in the period 1982–2014.

## Employment related to fisheries

Information about fisheries-related employment is provided in each of the country and territory chapters of this book. Most of the information presented is a heterogeneous collection of various types of data (with the exception of FFA's tuna-related employment data, which is collected uniformly across the region). The incomparability of the data creates difficulties in summarising the fisheries-related employment situation at the national level and in making intercountry comparisons. In reviewing the interface between employment surveys and the fisheries sector, one of the most significant observations made is that government statistics offices collect fisheries-related employment information with their own priorities and with diverse, often ineffective, methods, which results in incomparability of these data across the region. Considerable knowledge of the sector is required to enable the collection of useful information for the purposes of producing publications such as this one. Government fisheries officials and fishing industry participants have an important role to play in working with statistics office staff in defining terms and categories, formulating survey strategies and scrutinising survey results.

## Fish consumption

Information about the consumption of fish that is readily available is provided in the country and territory chapters of this book. This information is used to compile and compare the ranges in estimates of fish consumption across the region, from which the following observations can be made:

- In general, countries comprising mainly atolls such as Kiribati, Tuvalu and FSM have the highest fish consumption rates. The low fish consumption levels in the Marshall Islands appears to be counterintuitive, while low consumption levels in Tokelau can be explained by its close association with New Zealand which, with its relative affluence, facilitates the importation of protein alternatives to fish.
- The countries and territories with the lowest fish consumption rates either have large inland populations (such as PNG and Vanuatu) or are relatively affluent territories.
- In the context of fish consumption surveys, comparisons between different fish consumption studies must be embarked on cautiously. There is a strong argument for avoiding comparing fish consumption surveys unless the methods used by the comparative studies are known and these methods are comparable with the subject study, or the data are capable of adjustment to ensure comparability.

## Significant findings

The most important findings of this study are the following:

- Coastal fisheries production has not increased significantly in the 15-year period 1999–2014. This is despite indications at the national level of increasing fishing pressure. This is consistent with the thesis that the fish resources that support coastal fisheries in the region are fully or overexploited. Because the population of the region is increasing, the per capita production of fish from coastal fisheries decreased at a rate of approximately 6% in the period 2007–2014. This is a remarkable decrease in such a short period.
- Foreign-based offshore fishing continues to increase, with this fishing being responsible for almost all of the regional increase in fish catches in the period 2007–2014. This increase was mostly due to increased purse seine catches. This occurred despite the introduction of the PNA vessel day scheme and the associated steep increase in access fees, which were mostly paid by foreign purse seine fleets. The largest jump in access fees was between 2013 and 2014 (for countries where it was possible for the study to obtain access fees for both years), even though prices for skipjack (the main target of purse seining) decreased in that period. The fact that access fees increased, even though skipjack prices decreased, is a powerful argument for the effectiveness of the vessel day scheme.

## Technical recommendations

In total, 23 technical recommendations are made about how to improve measurement of the benefits of the fisheries sector in the region. Because many of the suggestions involve enhanced interaction between fisheries and statistics agencies, a general priority arising from this study is that mechanisms should be explored for encouraging this interagency cooperation. Other technical recommendations are the following:

- The paucity of information on coastal fisheries production is a problem in most countries in the region. If a fisheries agency cannot afford some type of snapshot fisheries survey, consideration should be given to that country obtaining such information from studies outside of the fisheries sector, such as a HIES, an agriculture census or a national census.
- In-country assistance from a specialist in small-scale fishery statistical systems could improve coastal fishery production estimates made by fisheries statistical systems, or this assistance could assess the degree of credibility (or lack of credibility) of the data produced by countries' existing systems.

- In-country assistance from regional and international development agencies in the production of fisheries agency annual reports could encourage the production and availability of reliable information on coastal fisheries. This would contribute to better measurement of the benefits of the fisheries sector.
- In analyses of the benefits from specific fisheries sub-sectors, efforts should be made to ensure that the analytical work is entirely independent from individuals involved in promoting the particular sub-sector.

## High-level recommendations

The study makes two specific high-level recommendations:

- The remarkable drop of per capita production from coastal fisheries over the period 2007–2014 should serve as a "wake-up call" for countries that do not place great importance on effective coastal fisheries management. Because coastal fisheries provide most of the fisheries-related employment and food in the region, there is both a moral and economic imperative to pursue the difficult task of implementing effective coastal management measures with greater vigour.
- Fees paid by foreign fishing operations for fishing in the region increased almost three-fold (279%, in real terms) between 2007 and 2014. This increase coincided with the period when the PNA vessel day scheme was introduced and became fully operational, and the scheme had increased its fees in countries that are parties to the Nauru Agreement. Access fees increased in real terms in all Pacific Island countries that licensed foreign fishing vessels. This is, among other factors, likely to reflect the long-term increase in the value of tuna globally. It is clear that increases in regional tuna catches experienced over the last six decades and the associated increase in access fees cannot continue forever. Efforts to diversify the benefits from offshore fisheries, including in the areas of GDP (e.g. by more local basing of tuna vessels), exports, employment and food, should receive more attention from PICTs in the region, drawing on earlier efforts to expand catches and increase foreign access fees.

**Box A1-1:** Some surprising facts to emerge from this study

- The 2014 tuna catch in Kiribati was 40.7% of the regional total and valued at about US$1 billion.
- 52.7% of all employment in the region directly related to the tuna industry occurs in PNG.
- The volume of production from the coastal commercial fisheries of Samoa in 2014 approached that of PNG. The volume of production from the coastal commercial fisheries of Fiji is almost twice as much as that of PNG despite having a population almost 9 times greater than Fiji.
- 93% of the value of all aquaculture in the region is produced in two French territories, French Polynesia and New Caledonia.
- In only six countries of the region is aquaculture significant (i.e. production value is greater than 5% of that of coastal fisheries) – all but one of those countries are territories (Cook Islands).
- American Samoa's fishery exports are about 47% of the fishery exports from all the other countries and territories combined. The value of PNG's fishery exports is about 41% of all the fishery exports from all the other independent countries combined.
- The total amount of fishery exports from the region fell about 42% in real value in the 2007–2014 period. The fall in the value of canned tuna exports from American Samoa was responsible for about 37% of the total regional decline.
- In just the period 2007–2014 (which coincided with the period when the vessel day scheme was introduced and became fully operational), access fees for foreign fishing increased 279%.
- In 2014, four countries of the region received access fees that equated to more than $1,000 per capita.

# Appendix 2: National Accounting and the Fisheries Sector

Gillett and Lightfoot (2001) give considerable detail in discussing aspects of the System of National Accounts (SNA) that are especially important to the fishing sector. Because that discussion is quite relevant to the present study, it is given here.

## Definitions and conventions in the system of national accounts

As with any system, there is a set of procedures and conventions that is used in compiling national accounts. The nature and application of these procedures and conventions must be taken into account when interpreting national accounts. Some of the important SNA concepts as applied to the fishing sector are given below.

### Productive activity

One of the most basic issues in the preparation of national accounts is the nature of activities that are included in the estimation of domestic product. In particular, any goods or services that are produced by a resident of a country for sale are included. Goods and services that are for sale are known as market production.

Service activities that are for personal or household consumption are not included in the calculation of national accounts. For example, house cleaning is not included if carried out by the family. These goods and services are known as non-market production or subsistence production. While the fish may have been caught for a family's own consumption, the convention assumes that the fish could have been sold, and therefore it should be treated as adding value to the economy. Clearly, this can be a significant issue for fisheries in the Pacific Island countries where large numbers of households rely on the harvest of aquatic resources for food and other uses.

### Residency

The nature and extent of residency is a core concept of the SNA. It defines what shall be counted as domestic product. For goods and services to be included in the domestic product of a particular country, a resident of that country must produce them. A resident is an individual or enterprise whose "centre of economic interest" is within the country. The "centre of economic interest" is determined by the following tests:

- Do residents of the country, in whose area the fishing activity occurs, get significant factor payments (i.e. wage or operating surplus) from the activity?
- Does the government of the country or the individual or the business entity located in the country, in whose area the fishing activity occurs, have a day-to-day influence on the way the fishing is carried out?
- Is the fishing based in the economic territory and/or employing local staff?
- Is the fishing an integral part of the domestic economy?

It is important to note that a resident need not be a citizen. The production of foreign nationals is treated as a domestic product provided the country is the "centre of economic interest" for the enterprise/individual. This concept is particularly important in the case of fishing where many of the enterprises are mobile, and it is common for vessels to be staffed by nationals from different countries. In effect, this means that the product of locally based offshore foreign vessels is treated as domestic product of the country from which they are operating, regardless of the nationality of the crew.

Under the SNA, the standard convention is to treat activities by a foreign operator that take place in a country for less than 12 months as being foreign activities. In the case of fishing, it is common for offshore foreign vessels to fish for only part of the year in local waters. In these circumstances, a strict interpretation of the SNA convention on "time in country" would treat these activities as foreign and only include the license fees as part of the national accounts. However, where the activities are seasonal and the main activity of the vessels is based locally, it would be more appropriate to follow the "centre of economic activity" convention and count their production as domestic product.

A related issue, which is particularly important in fishing, is the geographic extent of the "centre of economic interest". The SNA convention is to treat any activity as domestic provided it takes place within the "economic territory" of the country. The SNA boundary for domestic activity is not limited to the political boundary. It extends to include the "economic territory". This convention has particular importance for fishing, especially offshore fishing, which can take place a considerable distance from the land and political boundaries of a country. For example, the political boundary is usually confined to the territorial seas, which extend out to 12 miles from the high-water level. In practice, most countries use their exclusive economic zone (EEZ) when defining the geographic limits of their "economic territory"; and in the circumstances, this practice is the most appropriate.

Two other "geographic" issues that must be addressed in fishing are (1) how to treat fishing activities that take place in other jurisdictions and (2) how to treat those that take place in international waters.

When the fishing occurs in the waters of another country, determining how to treat that activity in the national accounts depends upon the duration of the activity and its "centre of economic activity". The SNA indicates that temporary work in a foreign country should be treated as domestic product in the home country (the centre of economic activity) of the entity carrying out the job. For example, the income earned by a consultant who normally resides in Fiji and undertakes a short-term contract in Samoa would be treated as Fiji domestic product, i.e. it is tantamount to an export (of services).

However, gross domestic product (GDP) is not intended to measure the production taking place within the geographical boundary of the economic territory. Some of the production of a resident producer may take place abroad, while some of the production taking place within the geographical boundary of the economy may be carried out by non-resident producer units. For example, a resident producer may have teams of employees working abroad temporarily on the installation, repair or servicing of equipment. This output is an export of a resident producer, and the productive activity does not contribute to the GDP of the country in which it takes place. Thus, the distinction between resident and non-resident institutional units is crucial to the definition and coverage of GDP.

This being the case, and in the absence of any indication to the contrary such as the formal relocation of the operation, fishing activity of less than 12 months in foreign waters should be treated as domestic product in the home country of the vessel owner/operator. Following the same convention, fishing that takes place in international waters may be domestic product of a country provided the operation is carried out by a resident and is temporary in nature. In some circumstances, fishing carried out in international waters could become a particularly perplexing problem for the compilers of national accounts. Where a fleet operates in international waters most of the time, including transshipping and re-supply, the question of whether to allocate the production as domestic or national product becomes an issue.

It is difficult to set strict rules since each situation is different. In practice, the compilers of national accounts will make judgments about where to allocate production of fleets that occurs on the "boundaries" of countries and nationality.

## Valuation

In all cases, national accounts are reported in monetary terms. Usually, the local currency is used, and almost always, the accounts are presented in current market (nominal) values and constant (real) values. Current market values use the value of the currency at the time of measurement. Constant values are indexed to the price levels of a specified year to remove the effects of price inflation and thereby allow the comparison of real changes over time. It is also common for international agencies such as the Asian Development Bank, International Monetary Fund, United Nations and World Bank to produce national accounts using the equivalent value of a convertible currency, usually the United States dollar (US$). This practice allows for easier cross-country comparison and tracking of changes in each country's international competitiveness.

An important valuation convention that is particularly relevant for fishing is the treatment of non-market household production (subsistence). Since by definition these items are not sold and the quantity produced is seldom recorded, it is necessary to make assumptions about their value. It is common practice to value non-market household production conservatively, and in some cases, production for own consumption is not even included in the national accounts.

## Assets

In the SNA, assets are restricted to things that are produced by an economic activity. This distinction is particularly important for natural resources and is a contentious issue, especially in relation to the overexploitation of natural resources.

Naturally occurring assets such as marine resources, minerals and forests do not enter the national accounts until they are being exploited and then only to the extent that they are being exploited. Unlike changes in inventories of produced assets, changes in the quantum of natural assets are not reflected in the national accounts. This convention ignores the very real impact that changes in the abundance of natural assets have on the "wealth" of an economy. This can result in misleading values being reported on fisheries and other sectors that rely on natural resources. For example, the income generated from the exploitation of fish is included in the national accounts, while the changes in abundance are not. In these circumstances, the short-term gain from the overexploitation of a fish stock shows up as a positive gain for the economy. If the changes in abundance were also taken into account, as happens with inventories of "produced assets," the apparent benefits for the exploitation of natural assets would be substantially reduced.

### Fishing vs fisheries

For the purpose of clarity, it is useful to distinguish between the terms "fishing" and "fisheries". "Fishing" is commonly used to describe the various activities involved in the harvest of aquatic resources, whereas "fisheries" is usually used to describe a broader range, from capture to post-harvest handling, transport, processing and marketing.

The conventions used in the SNA and those followed in this book are somewhat different. The categories of economic activities recognised by the SNA are those of the International Standard Industrial Classification of All Industrial Activities (ISIC). In this system, the category relevant to fisheries is ISIC 0500: "Fishing, operations of fish hatcheries and fish farms, service activities incidental to fishing." It is important to note the following:

- Post-harvest activities, including fish processing, are not included in the fishing sector – instead, they are generally counted in manufacturing and other sectors.
- Aquaculture is included in the sector.
- Subsistence fishing is a legitimate component of the fishing category.
- For convenience, the sector is usually referred to as "fishing".

## GDP considerations

It must be kept in mind that GDP is an estimate of economic activity; it is seldom a precise calculation. Even though the SNA sets out fairly straightforward procedures, in practice, the analyst is usually confronted with many uncertainties. Data are often unavailable, incomplete or suspect; hence, the analyst is forced to make judgments about what data to use and how those data should be treated. Some people may find this apparent lack of rigour disturbing, but it is usually unavoidable, especially in "messy" sectors like fishing. To make matters worse, the fishing sector is often only a small part of GDP, which means that only a limited amount of the analyst's time and effort can be expended on collecting data to update the estimate.

Typically, the sources of data an analyst would use to estimate the contribution of fishing include income and expenditure data from commercial operations, fisheries production and marketing information, and household income and expenditure data. Sometimes, secondary data like social security records, air-cargo records, international market reports, and various reports that bear on aspects of the industry might be used. The choice of which data set to use depends upon the analyst's judgment about the accuracy of the data, its coverage and the ease of accessing the information.

GDP and its component parts provide an important and very useful guide to the structure of an economy, but they do not show the impact of any activity on the economy. For example, the fishing contribution to GDP is limited to the value added to the economy by the activity of fishing, but the flow effects from the activity of fishing appear as value added by other sectors of the economy. The difference between "contribution" and "impact" can be illustrated by considering the consequences of an increase in fishing activity. If the amount of fishing activity increases by $1.0 million and the intermediate costs used in this activity are $0.4 million, then GDP will increase by $0.6 million. At the same time, the $0.4 million spent on the intermediate costs will directly increase the level of activity elsewhere in the economy. If $0.1 million of the $0.4 million were spent on provisions, the contribution by the "Wholesale and Retail" sectors to GDP would increase by $0.1 million, less any intermediate costs. In addition, the $0.6 million that has now been added to the fishing contribution to GDP is principally wages and profits, most of which will be spent by the recipients on goods and services. This, in turn, will increase the level of activity in other sectors of the economy.

The people who benefit from the sale of goods and services from "fishing" will, in turn, purchase goods and services from others, and thereby stimulate further activity. The cycle of activity thus generated by the initial production will have ripple effects throughout the economy. The aggregate impact will depend upon the extent to which the goods and services purchased are produced domestically, and the proportion of their income that people spend or save. The net effect on economic activity will almost certainly be far greater than the contribution to GDP. This cycle of impact is known as the multiplier effect.

In practice, multiplier effects can be fairly difficult to calculate. The dynamic nature of economies means that every action will be followed by a reaction. Changes in a sector will be at least partly offset by changes in the structure of the economy. This was illustrated by the response of households in Samoa to the impact of taro blight on their primary subsistence crop. Most households responded by switching their food production efforts to alternative crops, notably plantains. So, while the level of economic activity committed to taro production contracted, in terms of the overall level of economic activity in the economy, this contraction was largely offset by the increase in the level of activity in plantain production. While it was beyond the scope of this study to identify the multiplier effects of fishing, it remains an important issue.

# Appendix 3: Guidelines for Calculating the Fishing Contribution to GDP

## General

As with the estimation of any contribution to gross domestic product (GDP), the most appropriate method to use will depend on the nature of the data and the resources available to collect and analyse these data.

The compilers of national accounts must strike a balance between their desire for accuracy and the limitations on the time and effort they can dedicate to collecting and analysing data. In the case of fishing, striking this balance means that they are usually limited to using generalised estimates of income or production. In the consultant's opinion, the minimum level of aggregation that should be used would divide fishing into three categories: (1) locally based offshore fishing (foreign-based fishing in a country's zone does not contribute to that country's GDP), (2) coastal commercial fishing and (3) coastal subsistence fishing. In the Pacific Island countries that have significant freshwater fisheries (e.g. Papua New Guinea [PNG] and Fiji) or aquaculture (e.g. the Cook Islands and New Caledonia), these categories should be added.

In general, where good and comprehensive data exist at the fishing enterprise level, the income approach to estimating fishing contribution is likely to be the most accurate, informative and timely. Some of the recent studies by the Development of Tuna Fisheries in the Pacific ACP Countries (DevFish) are in this category (e.g. Philipson 2006; Philipson 2007b; P. Philipson, per. com. November 2008). Unfortunately, such data at the enterprise level is usually not available; it either does not exist or is confidential. Applying the income approach to estimating GDP becomes especially difficult when dealing with the many small companies that are involved in coastal commercial fishing in most Pacific Island countries. The production approach may be the only viable option for calculating fishing contribution to GDP.

Although the production approach may be the most practical method to use in estimating the contribution fishing to GDP, the compilers of national accounts should, in many cases, be aware of and compensate for some important weaknesses in that approach, as follows:

- The assumption of fixed value-added ratios (discussed in the section below). In practice, these ratios are subject to substantial variation, more so than in any other industrial sectors. Major causes of this are changes in catch rates and prices.

- The difficulty of estimating prices. Typically, prices for fish vary widely by fish size, species, product form, season and market, and thus average price estimates derived from price data, as opposed to revenue data, can be substantially inaccurate.
- The need for specialised knowledge of the fishing sector. While the compilers of national accounts using the income approach can deal with fishing companies in much the same way that they deal with any commercial enterprise, the production approach requires greater insight into the special attributes of the sector. This involves knowledge of items like identification/inclusion of all significant components of the fishing sector, aggregation of the similar components of the fishing sector (discussed above), determining value-added ratios (discussed below) and estimating prices.

The difficulties with the production approach can be at least partially compensated for in several ways. Periodic surveys can be undertaken to "ground truth" the assumptions on value-added ratios and prices. Export data can be used to estimate the production of large-scale commercial fishing, but official export figures are often inaccurate. In many countries, the most appropriate mechanism for dealing with difficulties of the production approach is simply more frequent and effective liaison between compilers of national accounts and government fisheries officials.

## Value-added ratios

The production approach to estimating the fishing contribution to GDP requires two basic sets of data: (1) value of gross output of fishing and (2) intermediate costs.

It is usually convenient to express the intermediate costs as a proportion of the gross output. For example, in the case of small-scale fishing using motorised boats, the fuel, bait, provisions and maintenance are all intermediate costs. If the total value of the catch is $1,000 and the sum of the intermediate costs is $400, then the proportion of the gross output attributable to intermediate costs is 40%. Therefore, the value added by small-scale fishing using motorised boats is $1,000 * (1 - 0.40) = $600. In this example, the intermediate cost ratio is 0.40 and its reciprocal (0.60) is the value-added ratio (VAR). It should be noted that the intermediate costs refer to operating expenses. Expenditures on large capital items, such as engines, are capital expenditures and thus are not counted as intermediate costs.

In practice, each operator is likely to have a different value-added ratio.

However, in the preparation of national accounts, it is usually not possible to individually measure each operation. The normal practice is to estimate an average value-added ratio for each type of activity for each country.

### Calculating value-added ratios

**Offshore fishing:** All the enterprises involved in this sector are of large-scale commercial operations. Of necessity, these enterprises keep records of their income and expenditure from which it is possible to calculate a value-added ratio. If income and expenditure data are available for every enterprise in the sector, an income approach to calculating the value-added ratio would normally be used. However, when this is not the case, analysts must resort to using a production approach based on overall production from large-scale fishing and price data. In these circumstances, a sample of the income expenditure of one or more typical enterprises can be used to calculate the value-added ratio for the sector.

**Coastal commercial fishing:** This sector is usually more diverse than large-scale commercial operations. There is often a marked difference in the type of vessel used by each enterprise. Typically, the vessels used could be specially designed fishing boats with inboard motors, outboard skiffs and canoes. The cost of operating each type of vessel differs, and hence, the value-added ratio of the related activity also differs. Some enterprises may keep income and expenditure records, but many do not. Also, it is often difficult to split the sector catch between each class of activity. In the circumstances, the analyst usually must resort to using a generalised estimate of value-added ratios based upon information about the composition of the fleet. Information from which to estimate the value-added ratios for small-scale fishing may be available from (1) the records of development banks and other financial institutions, (2) surveying the sector, (3) published reports on the sector, including studies into the benefit/cost of proposed development projects, and (4) anecdotal information from discussions with people involved in the sector.

**Subsistence fishing:** The subsistence sector is also quite diverse. Subsistence fishing can include gleaning, canoe fishing, gill netting, cast nets, fish drives, fish traps, torch fishing and trolling from motorised skiffs. While the value-added ratio for each activity is different, in general it should be possible to categorise subsistence fishing into two sets of activities: (1) those that involve motorised boats, and (2) those that do not. Non-motorised fishing activities have a very low level of intermediate cost and therefore, a high value-added ratio. It would be rare for the value-added ratio of non-motorised activities to be less than 90%. In contrast, motorised subsistence fishing activities range from high-cost trolling to medium- and low-cost bottomfishing. Estimating the value-added ratio of non-motorised activities is likely to prove most difficult – but given the high percentage of value added in these activities, slight errors in the value-added ratio used for them is unlikely to result in a major difference in the estimated contribution to GDP. The value added from motorised subsistence fishing activities should be very similar to that of small-scale commercial fishing. Given the difficulty in separating the gross output of each activity in the subsistence sector, a reasonable approach is to estimate an average value-added ratio weighted by the proportion of the catch (by value) taken by non-motorised and by motorised fishing activities.

**Aquaculture:** Village-level aquaculture in the region, most commonly involving tilapia and seaweed, has characteristically low intermediate costs. Financial records are often not maintained and consequently, estimating valued added can involve considerable speculation. On the other hand, the relatively large-scale aquaculture operations of the region, mostly pearls and shrimp, have much higher intermediate costs. Good financial records are kept, but commercial secrecy becomes an issue in accessing the data for determining value added.

**Freshwater:** There is no good data on overall freshwater fishery production in any Pacific Island country, and any estimate involves a considerable amount of "educated" guesswork. Most of the production is for subsistence purposes and should be valued accordingly. The catch is mostly taken with low-technology gear, associated with high value-added ratios. In some Pacific Island countries, there is a significant amount of non-subsistence freshwater fishing, such as commercial fishing in the rivers of PNG and the capture of *Macrobrachium* shrimp for roadside sales in Fiji.

### Value-added ratios from previous studies

The value-added ratios used by the earlier study (Gillett and Lightfoot 2001) are given in Box A3-1.

**Box A3-1:** Value-added ratios used in Gillett and Lightfoot (2001)

| The value-added ratios used in the earlier study were generally: | VAR |
|---|---|
| Large-scale offshore fishing | 40–55% |
| Small-scale commercial fishing | 55–70% |
| Subsistence | |
| Non-motorised | 90% |
| Motorised | 65–75% |
| Aquarium fish | 65% |
| Seaweed cultivation | 90% |
| Pearl culture | 80% |

Source: Gillett and Lightfoot (2001)

Although the above VARs were the best available at the time, there is considerable room for improvement. The Gillett and Lightfoot study stated: "Additional information on the economics of small-scale fisheries would contribute to improving the measurement of the fisheries contribution to GDP." Accordingly, subsequent Benefish studies (i.e. Gillett [2009a], Gillett [2016]) devoted considerable attention to gathering information from which improved VARs could be derived, with an emphasis on small-scale fishing and aquaculture. The data in the various reports of different types and scales of fishing were scrutinised and value-added ratios were calculated.

**Table A3-1:** Value-added ratios from various studies of small-scale fishing and aquaculture

| Category | Activity/location | Source/date | VAR |
|---|---|---|---|
| Non-vessel fishing | Fishing without use of vessel, Niue; using rods from the reef top by walking | Kronen (2008a), study carried out May–June 2005 | 0.92 |
| | Fishing without use of vessel, Pohnpei, Federated States of Micronesia. Fishing activity included mainly (in descending order) spearing, line fishing and netting | Rhodes et al. (2007), study carried out January 2006 to January 2007 | 0.89 |
| Non-motorised fishing | Non-motorised canoe fishing, Pohnpei, Federated States of Micronesia. Fishing activity included mainly (in descending order) spearing, line fishing and netting | Rhodes et al. (2007), study carried out January 2006 to January 2007 | 0.91 |
| | Non-motorised canoe fishing, Niue; deep-bottom fishing and/or the use of fishing rods and handlines from non-motorised canoes | Kronen (2007), study carried out May–June 2005 | 0.95–0.98 |
| Fishing from small outboard powered skiffs | Tuna trolling from outboard-powered skiffs in Tarawa, Kiribati. | R. Stone, Forum Fisheries Agency, unpublished data, 2007 | 0.60 |
| | Outboard-powered fishing with engines 6–40 hp, Pohnpei, Federated States of Micronesia. Fishing activity included mainly (in descending order) spearing, line fishing and netting | Rhodes et al. (2007); study carried out January 2006 to January 2007 | 0.74–0.79 |
| | Small boat fishing in New Caledonia; outboard vessels 3.4–4.5 m in length | Dupont et al. (2004); data from 2002–2004 | 0.65 |
| | Small boat fishing in New Caledonia; outboard vessels 4.5–5.5 m in length | Dupont et al. (2004); data from 2002–2004 | 0.80 |
| | Motorised skiff fishing, Niue; using motorised boat transport for deep-water and pelagic fishing | Kronen (2007), study carried out May–June 2005 | 0.61–0.72 |
| | "Artisanal fishing" in Fiji | Reddy (2004), data from June 2003 to January 2004 | 0.51 |

| Category | Activity/location | Source/date | VAR |
|---|---|---|---|
| Fishing from vessels larger than 7 meters | Small boat fishing in New Caledonia; inboard vessels 7–8 m in length | Dupont et al. (2004), data from 2002–2004 | 0.65 |
| | Small boat fishing in New Caledonia; inboard vessels 8.4–11.96 m in length | Dupont et al. (2004), data from 2002–2004 | 0.60 |
| | Alia longline fishing in Samoa; Apia based | Hamilton (2007), data from 2006 | 0.47 |
| | Alia longline fishing in Samoa; rural Upolu based | Hamilton (2007), data from 2006 | 0.48 |
| | Alia longline fishing in Samoa; Savaii based | Hamilton (2007), data from 2006 | 0.39 |
| Aquaculture | Tilapia farming model developed for the Pacific Islands, 2 pond farm (20x30 m), mill mix feed | SPC (unpublished data) | 0.74 |
| | Large-scale pearl culture in Fiji | J. Hunter (Personal communication, November 2008) | 0.452–0.508 |
| | Pearl culture in the Cook Islands, 30% technician paid locally | R. Newnham (personal communication, October 2008), years 2005 and 2006 | 0.41 (2005)<br>0.21 (2006) |
| | Pearl culture model developed for medium-size pearl farm in Kiribati | SPC (unpublished data) | 0.69 |
| | Live rock culture in Fiji | Lal and Cerelala (2005), data from 2000–2004 | 0.40 |
| | Seaweed culture in the Solomon Islands | Cospi (2007) | 0.72 |
| Other | Coral harvesting in Fiji | Lal and Cerelala (2005), data from 2000–2004 | 0.70 |

Source: As per source/date column in the table

The ratios in Table A3-1 should be considered indicative, rather than precise. In many of the studies listed there is a lack of information on taxes, depreciation and loan interest, which may have several percentage points of effect on the VARs.

Some work has been conducted recently on value-added ratios for offshore tuna fishing in the region. In 2006/07, the Forum Fisheries Agency/Pacific Community DevFish project enjoyed access to financial information at the enterprise level in several Pacific Island countries. On the basis of examining records at several longline and purse seine fishing companies, it was concluded that a value-added ratio of 0.20 should be used for the period 2005–2007 for locally based longlining and 0.496 for purse seining (Philipson 2006; Philipson 2007a; P. Philipson, per. com. November 2008). From Smith and Tamate (1999), likely the best source of information for the VAR for industrial pole-and-line tuna fishing, a VAR of 0.60 has been estimated.

## Value-added ratios used in this book

In view of the above studies and experience gained from the previous Benefish studies, the value-added ratios in Table A3-2 (below) are generally used in this book. Some judgment is, however, required in using the VARs. Depending on the national situation, the mix of fishing activities and the associated intermediate costs of those activities, the value-added ratios used in this book may sometimes vary from Table A3-1.

**Table A3-2:** Value-added ratios used in this book

| Category of fishing/aquaculture | Specific type | VAR |
|---|---|---|
| Offshore tuna fishing | Locally based longlining | 0.20 |
| | Locally based purse seining | 0.50 |
| | Locally based pole-and-line | 0.60 |
| Coastal commercial and subsistence | Fishing without a boat | 0.90 |
| | Fishing in non-motorised canoe | 0.92 |
| | Fishing with small outboard boat | 0.60–0.80 |
| | Tuna trolling | 0.60 |
| | Alia longline fishing | 0.47 |
| Aquaculture | Pearl culture | 0.45 |
| | Tilapia culture | 0.74 |
| | Seaweed culture | 0.72 |
| | Coral culture | 0.40 |
| Other | Coral harvesting | 0.70 |
| | Aquarium fish collection | 0.65 |

Source: Consultant's selective use of information in this section

It should be noted that many of the VARs in the above table have been crudely estimated, and steps should be taken to revise them when improved data become available. Towards the end of the present study, an economic statistician generously provided some data on the value added by locally based purse seine vessels in a Pacific Island country. The data obtained was from the actual accounts of four companies, which is a great improvement from estimations made from publicly available information. Table A3-3 summarises the VARs obtained.

**Table A3-3:** Value-added ratios for obtained from purse seine company accounts

| | Period covered | Range in VARs | Average VAR over the period |
|---|---|---|---|
| Company A | 2009–2021 | 35.4–64.1% | 52.1% |
| Company B | 2012–2021 | -22.5–38.3% | 12.7% |
| Company C | 2006–2020 | 27.1–61.7% | 47.1% |
| Company D | 2006–2020 | -21.0–54.1% | 28.5% |

Source: G. McKinlay (per.com. March 2023)

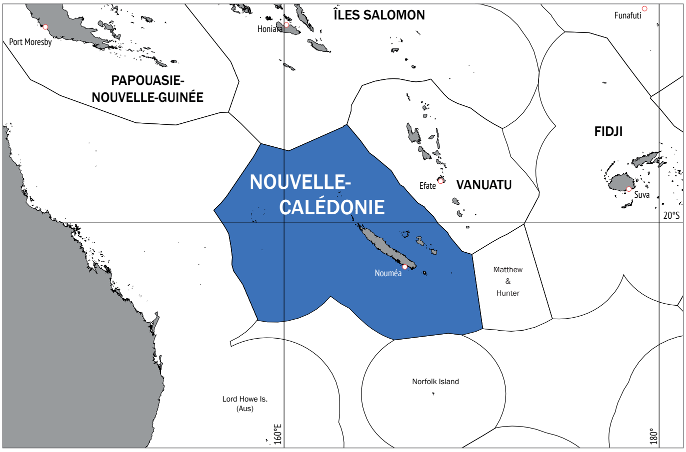
The purse seine value-added ratios from the four studies ranged from -22.55 to 64.1%. The average VAR for purse seining for all four companies was 35.1%.

From Table A3-2 (above) on the value-added ratios used in this book, the purse seine VAR used was 50%. Although the new purse seine information above arrived too late to be used in the present study, future studies should consider using a modified VAR based on the above analysis of the accounts of the four purse seine companies.

It should be noted that this short exercise on VARs reveals greater variability and volatility in VARs than the generic methods used in past Benefish studies. To do similar analyses in the future for other types of industrial fishing operations requires companies to provide sufficiently detailed accounts and respond to additional queries. It also requires more staff resources and skill to analyse the data.

# Version française des chapitres relatifs aux Territoires français du Pacifique

# Appendix 4: Nouvelle-Calédonie




## A4.1 Volume et valeur de la production halieutique de Nouvelle-Calédonie

### Captures de la pêche professionnelle côtière de Nouvelle-Calédonie

Les pêches maritimes en Nouvelle-Calédonie se répartissent en trois catégories :

- La pêche lagonaire, pratiquée à l'intérieur du récif à bord de petits bateaux ou à pied.
- La pêche côtière, pratiquée à l'extérieur du lagon jusqu'à une distance de 22 km au-delà du récif.
- La pêche hauturière, pratiquée dans la zone économique exclusive.

Aux fins de la présente étude, les deux premières catégories définies ci-dessus correspondent à la « pêche côtière ».

On distingue deux catégories de pratiquants de la pêche lagonaire et côtière en Nouvelle-Calédonie :

- Les pêcheurs professionnels : la pêche est leur métier, ils ont obtenu une autorisation délivrée par leur province et ils bénéficient de diverses subventions publiques.
- Les pêcheurs non professionnels : la pêche n'est pas leur métier, ils pratiquent la pêche de loisir ou pêchent pour nourrir leur famille.

La production halieutique côtière de la Nouvelle-Calédonie a déjà fait l'objet de plusieurs tentatives d'évaluation, dont voici la synthèse :

- Sur la base des statistiques officielles des captures publiées par la Nouvelle-Calédonie pour 1992 et 1993, Dalzell et al. (1996) ont estimé la production de la pêche professionnelle côtière du Territoire à 981 tonnes (soit une valeur de 3 968 650 dollars É.-U.) et celle de la pêche côtière vivrière à 2 500 tonnes (soit 9 millions de dollars É.-U.).
- Dupont et al. (2004) sont parvenus à l'estimation suivante de la production annuelle en 2002 et 2003 : a) pêche professionnelle lagonaire et côtière : 1 200 tonnes, 238 embarcations, 492 pêcheurs ; b) prises destinées à l'autoconsommation (pêche vivrière et plaisancière) : 3 500 tonnes.
- À partir des estimations réalisées par Dupont et al. de la production déclarée de la pêche professionnelle récifo-lagonaire en 2006 et 2007, ainsi que des prix officiels du poisson en 2006, Gillett (2009a) a produit les estimations suivantes pour l'année 2007 : a) production de la pêche côtière professionnelle : 1 350 tonnes, soit une valeur de 756 millions de francs CFP à la première vente ; b) production de la pêche côtière vivrière : 3 500 tonnes, soit 1,372 milliard de francs CFP valeur départ pêcheur.
- Sur la base de données récentes relatives à la production halieutique côtière de la Nouvelle-Calédonie, Gillett (2016) concluait que la meilleure méthode pour procéder à une estimation de la production globale consistait à poser l'hypothèse d'un volume de production équivalent à celui de l'étude de Gillett (2009a) dont la valeur s'était appréciée de 21 %. En suivant cette logique, l'auteur estimait que la production de la pêche côtière professionnelle s'établissait à 1 350 tonnes, soit une valeur de 915 millions de francs CFP à la première vente.

Le rapport d'activité publié chaque année par l'Observatoire des pêches côtières de Nouvelle-Calédonie fourmille d'informations sur la pêche côtière professionnelle. Le tableau A4-1 a été établi à partir des deux dernières éditions de cette publication.

**Tableau A4-1 :** La pêche côtière professionnelle en quelques chiffres

| | 2019 | 2020 |
|---|---|---|
| Nombre de pêcheurs professionnels | 601 | 543 |
| Nombre de navires de pêche côtiers | 503 | 459 |
| Captures déclarées en tonnes | 939 | 837 |
| Chiffre d'affaires en francs CFP | 600 000 000 | 598 000 000 |
| Chiffre d'affaires par kg | 639 | 913[1] |

Source : OPC (2021), OPC (2022)

[1] Le chiffre d'affaires divisé par les prises déclarées pour 2020 est égal à 714 francs CFP/kg, soit un prix de vente moyen qui diffère de celui qui figure dans le tableau (913 francs CFP). Le chiffre d'affaires divisé par les prises déclarées pour 2019 est égal à 639 francs CFP/kg, à savoir la même valeur que celle qui figure dans le tableau. Aux fins de la présente étude, nous partons de l'hypothèse d'un prix de vente au kilo de 714 francs CFP pour 2020 que nous utiliserons pour projeter la valeur des captures pour 2021.

Entre 2019 et 2020, le nombre de pêcheurs professionnels et d'embarcations de pêche côtière a diminué, alors que le chiffre d'affaires au kilogramme enregistrait une très forte hausse, la pandémie de COVID-19 expliquant sans doute en grande partie cette évolution.

La composition des captures est détaillée dans le tableau A4-2. On constate qu'en 2020, les poissons représentaient 65 % des prises.

**Tableau A4-2 :** Composition des captures de la pêche côtière professionnelle (tonnes)

| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| Espèces de poisson lagonaires et récifales | 450 | 466 | n/d | n/d | 545 | 522 | 545 |
| Trocas | 127 | 146 | n/d | n/d | 14 | 7 | 8 |
| Holothuries (poids sec) | 52 | 45 | n/d | n/d | 46 | 37 | 21 |
| Crustacés | 62 | 63 | n/d | n/d | 78 | 90 | 82 |
| Mollusques | 9 | 9 | n/d | n/d | 10 | 18 | 14 |
| **Total lagon et récif** | **699** | **730** | **n/d** | **n/d** | **693** | **674** | **670** |

Source : données non publiées, Service de la marine marchande et des pêches maritimes ; ISEE/Douanes
n/d : données non disponibles

Il n'est pas aisé de déterminer le volume effectif total des prises de la pêche côtière professionnelle en procédant par extrapolation à partir de la production déclarée. En dépit de nombreux échanges avec les agents des services des pêches et d'autres acteurs du secteur en Nouvelle-Calédonie, les auteurs n'ont pu obtenir la moindre estimation de la production non déclarée. Il est à noter que les nombreuses subventions dont bénéficient les pêcheurs professionnels incitent ces derniers à s'immatriculer comme tels et à déclarer leurs captures. Faute de mieux, on partira ici de l'hypothèse que la production commerciale déclarée est égale à la production commerciale totale.

L'année 2020 est la dernière pour laquelle on dispose de données relatives à la production de la pêche côtière professionnelle en Nouvelle-Calédonie. Pour procéder à une estimation de la production de l'année 2021 (qui fait l'objet de la présente étude), il importe de tenir compte des répercussions de la pandémie de COVID-19. Selon le responsable du bureau des pêches de la Province Sud, si le volume des captures de la pêche côtière professionnelle a peu varié entre 2020 et 2021, le prix du poisson a en revanche augmenté (B. Fao, communication personnelle, septembre 2022). Aux fins de la présente étude, nous partirons de l'hypothèse d'une augmentation de 8 % du prix du poisson départ pêcheur entre 2020 et 2021 (soit 771 francs CFP/kg en 2021).

Sur la base des données ci-dessus, le volume de la production de la pêche côtière professionnelle en 2021 est estimé à 680 tonnes, soit une valeur départ pêcheur de 524,28 millions de francs CFP.

## Captures de la pêche côtière vivrière

Aux fins de la présente étude, nous considérons que les captures de la pêche plaisancière sont destinées à l'autoconsommation et relèvent donc de la pêche vivrière.

Le rapport annuel de l'Observatoire des pêches côtières pour 2021 (OPC 2022) indique que les pêcheurs non professionnels prélèvent 85 % du volume de poissons lagonaires consommés sur le Territoire. On constatera que les « prises lagonaires des pêcheurs non professionnels » ne correspondent pas exactement aux « captures de la pêche côtière vivrière » dont il est question dans la présente étude. En 2021, ces dernières sont donc estimées à quelque 4 760 tonnes, soit une valeur de 2 568 972 000 francs CFP départ pêcheur, calculée sur la base du prix à la production.

## Captures des unités de pêche hauturière locales

On dispose de données d'excellente qualité sur les captures de la pêche hauturière locale. La flottille fait en effet l'objet d'un suivi pluriel : système de suivi électronique des navires, observateurs embarqués, données des fiches de pêche et débarquements des prises.

Le rapport annuel de la Nouvelle-Calédonie au Comité scientifique de la Commission des pêches du Pacifique occidental et central (Anon. 2022b) fournit les informations suivantes :

> La flottille locale de palangriers a commencé à se constituer à partir de 1983 et le début des années 2000 a été marqué par une forte augmentation du nombre d'unités de pêche. Toutefois, à partir de 2003 le manque de personnel qualifié n'a plus permis d'exploiter pleinement les navires et plusieurs armements ont cessé leur activité. Le nombre de navires de pêche a continué à diminuer progressivement jusqu'en 2013, les effectifs de la flottille se stabilisant alors : on dénombrait 6 ou 7 compagnies et 16 à 18 palangriers en activité chaque année. En 2021, on comptait 18 palangriers détenteurs d'une licence. L'un d'entre eux a toutefois dû cesser son activité pour cause d'obsolescence. Aucun des navires en activité en 2021 ne dépasse 200 tonneaux de jauge brute. Les plus grands des palangriers de la flottille, dont la

jauge brute avoisine les 150 tonneaux, peuvent rester en mer pendant au moins deux semaines. En moyenne, les campagnes de pêche durent 12 jours, dont 8 jours de pêche. En 2021, 347 sorties ont été déclarées, pour un total de 4 120 jours en mer.

**Tableau A4-3** : Captures des unités de pêche hauturière locales (tonnes)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Germon | 1 734 | 1 752 | 1 965 | 1 903 | 1 774 |
| Thon jaune | 559 | 467 | 664 | 515 | 624 |
| Thon obèse | 48 | 46 | 37 | 51 | 59 |
| Makaire noir | 65 | 28 | 29 | 32 | 34 |
| Marlin bleu | 34 | 13 | 11 | 10 | 16 |
| Thon rouge du Pacifique | 1 | 1 | 1 | 0 | 0 |
| Bonite | 41 | 15 | 11 | 8 | 11 |
| Marlin rayé | 77 | 52 | 84 | 81 | 97 |
| Espadon | 22 | 8 | 8 | 9 | 10 |
| **Total des captures (tonnes)** | **2 581** | **2 382** | **2 810** | **2 609** | **2 626** |

Source : adapté de Anon. (2022a)

Les informations disponibles sur la valeur des captures de la pêche hauturière de Nouvelle-Calédonie sont parcellaires.

- Il ressort du rapport annuel de la Nouvelle-Calédonie au Comité scientifique de la Commission des pêches du Pacifique occidental et central (Anon. 2022b) que le revenu brut de la flottille locale de palangriers avoisinait le milliard de francs CFP et que l'augmentation de la production en 2021 laissait présager une amélioration des résultats.
- L'Agence des pêches du Forum (FFA) procède chaque année à une estimation du volume et de la valeur des captures de thons de l'ensemble des pays pratiquant la pêche thonière industrielle dans le Pacifique occidental et central. Selon la FFA (2022b), la valeur des prises de thons de la flottille palangrière de Nouvelle-Calédonie s'établissait à 10 833 473 dollars É. U. en 2021, soit 1 141 523 050 francs CFP, un chiffre très proche de l'estimation d'Anon. (2022a) donnée plus haut.
- Un maître de pêche de la CPS fort d'une longue expérience de la pêche palangrière en Nouvelle-Calédonie nous a fourni les estimations suivantes du prix du poisson « en direct du bateau » : germon : 600 francs CFP/kg, thon jaune : 1 000 francs CFP/kg et thon obèse : 1 400 francs CFP/kg (W. Sokimi, communication personnelle, février 2023).

Aux fins de la présente étude, nous partons de l'hypothèse d'un volume de captures de la pêche hauturière locale de 2 625 tonnes, soit une valeur de 1 846 millions de francs CFP.

### Captures des unités de pêche hauturière battant pavillon étranger

Depuis la signature en 2001 des derniers accords de pêche entre la France et le Japon, on ne compte aucun navire étranger détenteur d'une licence de pêche ou affrété pour pratiquer la pêche dans la zone économique exclusive de la Nouvelle-Calédonie (Anon. 2022b).

### Captures en eau douce

On ne dispose que de peu d'informations sur la pêche en eau douce en Nouvelle-Calédonie. D'après les dires d'un agent de la Direction des affaires maritimes, cette activité est pratiquée exclusivement à des fins vivrières et les prises se composent pour l'essentiel d'anguilles, de chevrettes *Macrobrachium* et d'espèces de petits poissons (R. Etaix-Bonnin, communication personnelle, août 2008). Un employé du service des pêches de la Province Sud signale qu'on pratique la pêche du black-bass dans le lac de Yate (T. Tiburzio, communication personnelle, septembre 2022).

On peut estimer à quelque 10 tonnes le volume des captures annuelles de la pêche dulcicole, soit une production d'une valeur de 5,397 millions de francs CFP si l'on adopte la même méthode de calcul que pour la pêche côtière vivrière.

### Production aquacole

Une étude régionale consacrée à l'aquaculture dans les pays océaniens (IAS 2022) apporte les informations suivantes sur la filière aquacole de Nouvelle-Calédonie :

- Espèces actuellement produites à des fins commerciales : Crevette bleue (*Litopenaeus stylirostris*) : environ 2 000 tonnes par an, dont la plus grande part est exportée. Huître de roche locale (*Saccostrea cucullate*) : production annuelle de 12 000 douzaines destinée au marché local. Collectage de naissains en milieu naturel. Aquariophilie à petite échelle : poissons (les espèces dépendent des prélèvements), coquillages (principalement des *tridacnidae*), coraux mous (principalement *Sarcophyton* spp et *Sinularia* spp) et hippocampe de la mer de Corail (*Hippocampus semispinosus*). Pour 2018, la Banque mondiale chiffre cette production à 1 716 tonnes (a priori principalement composée de crevettes).

- Espèces actuellement exploitées pour la sécurité alimentaire et la production communautaire à petite échelle : Aucune
- Autres espèces dont l'élevage a été tenté : Holothurie (*Holothuria scabra*) dans les bassins de crevettes. Le stade de la production commerciale n'a pas encore été atteint.
- Stratégie future et orientations planifiées : Poisson : pouatte (empereur rouge), picot rayé (sigan raies d'or, *Siganus lineatus*), picot gris (*Siganus fuscescens*).

L'aquaculture néo-calédonienne est dominée par la crevetticulture. En moyenne sur les dix dernières années, la production de crevettes a oscillé autour de 1 500 tonnes, avec des bassins d'élevage d'une superficie totale de quelque 650 hectares. Le premier marché de la filière est la Nouvelle-Calédonie (qui absorbe environ 46 % de la production), suivi du Japon (39 %) (IEOM 2019).

Au dire d'un responsable de l'Agence rurale de Nouvelle-Calédonie, la production de crevettes du Territoire s'élevait à 1 472 tonnes en 2020 et à 1 470 tonnes en 2021. Le chiffre d'affaires à la première vente en 2020 s'établissait à 1,949 milliard de francs CFP (soit 1 324 francs CFP/kg), les chiffres pour 2021 n'étant pas encore disponibles (V. Roussery, communication personnelle, septembre 2022).

Parmi les rares informations complémentaires disponibles sur la production aquacole de la Nouvelle-Calédonie, on notera les suivantes :

- On ne trouve que peu d'informations sur le volume et la valeur de la production des huîtres gigas, en dehors des chiffres mentionnés plus haut issus de la publication IAS (2020) (production annuelle de 12 000 douzaines) et de données non publiées du Service de la marine marchande et des pêches maritimes indiquant que la production annuelle s'établissait à quelque 70 tonnes de 2007 à 2011, dernière année pour laquelle on dispose de statistiques.
- Il ressort de la publication « Pêches professionnelles maritimes et aquaculture 2016 – 2018 » (DAM 2019) que la production totale de l'aquaculture sur le Territoire s'établissait à 1 517 tonnes, dont 12 tonnes de pouattes (empereur rouge), en 2018. Cette même année, le chiffre d'affaires global de la filière aquacole à la première vente était de 1,854 milliard de francs CFP, soit un prix moyen à la première vente de 1 156 francs CFP/kg.

- Selon les estimations de Gillett (2016), en 2014, la production annuelle d'écrevisses d'eau douce se situait entre 3 et 4 tonnes, alors que celle des huîtres gigas oscillait entre 40 et 80 tonnes (données non publiées de la DAM). Le prix à la première vente de ces produits était estimé à 90 millions de francs CFP en 2014.
- Plusieurs agents des services publics ont mentionné la production de petites quantités de siganidés et de tilapias.

Il n'est pas possible de procéder sur cette base à une estimation précise de la production aquacole en 2021, les données relatives aux produits autres que la crevette étant très parcellaires.

Une approximation grossière de la production aquacole en 2021 établit cette dernière à 1 538 tonnes (soit 1 470 tonnes de crevettes et 68 tonnes d'autres produits), pour une valeur de 2,088 milliards de francs CFP.

## Synthèse des captures

Le tableau A4-4 présente une approximation grossière du volume et de la valeur à la première vente de la production annuelle de la pêche et de l'aquaculture en Nouvelle-Calédonie pour l'année 2021.

**Tableau A4-4** : Production annuelle de la pêche et de l'aquaculture en Nouvelle-Calédonie, 2021

| Secteur de production | Volume (tonnes) | Valeur (francs CFP) |
|---|---|---|
| Pêche côtière professionnelle | 680 | 524 280 000 |
| Pêche côtière vivrière | 4 760 | 2 568 972 000 |
| Pêche hauturière locale | 2 625 | 1 846 000 000 |
| Pêche hauturière étrangère | 0 | 0 |
| Pêche en eau douce | 10 | 5 397 000 |
| Aquaculture | 1 538 | 2 088 000 000 |
| **Total** | **9 613** | **7 032 649 000** |

Les figures A4-1 et A4-2 illustrent le volume et la valeur de la production de la pêche et de l'aquaculture en Nouvelle-Calédonie en 2021.

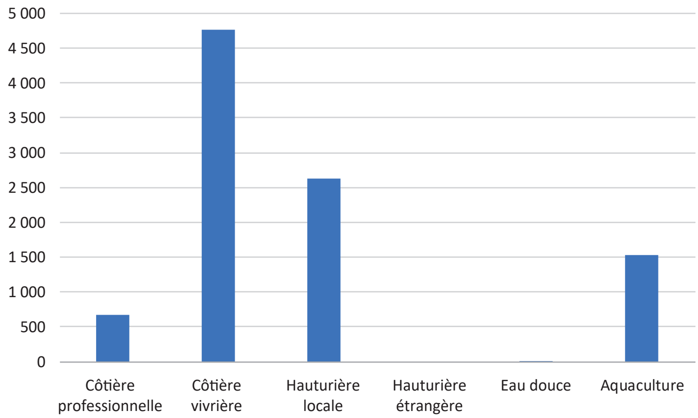



**Figure A4-1 :** Volume de la production halieutique de Nouvelle-Calédonie en 2021 (exprimé en tonnes)

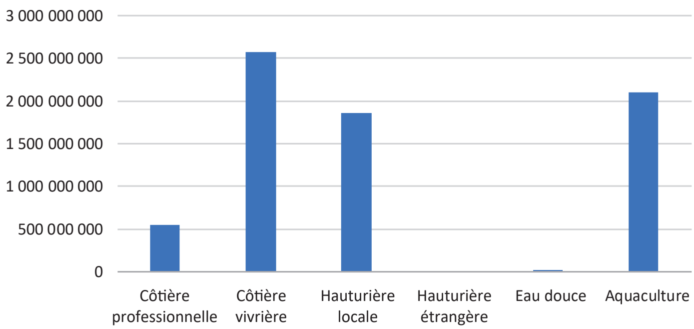



**Figure A4-2 :** Valeur de la production halieutique de Nouvelle-Calédonie en 2021 (exprimée en francs CFP)

## Estimation de la production halieutique dans les précédentes études Benefish

Un certain nombre d'études portant sur les retombées de la pêche dans les pays océaniens (Études Benefish) ont déjà été réalisées. Gillett et Lightfoot (2001) se sont intéressés à l'année 1999, Gillett (2009a) à 2007, Gillett (2016) à 2014, tandis que la présente étude porte sur l'année 2021. Les niveaux de la production halieutique de Nouvelle-Calédonie estimés à partir de ces études sont reproduits au tableau A4-6[2].

2 L'étude Benefish la plus ancienne, réalisée par Gillett et Lightfoot (2001), ne prend en compte ni l'aquaculture, ni la pêche en eau douce, ni les Territoires non indépendants.

Tableau A4-5 : Estimations de la production annuelle de la pêche et de l'aquaculture issues des études Benefish

| | Année | Volume (tonnes) | Valeur nominale (francs CFP) |
|---|---|---|---|
| Pêche côtière professionnelle | 1999 | n/d | n/d |
| | 2007 | 1 350 | 756 000 000 |
| | 2014 | 1 350 | 915 000 000 |
| | 2021 | 680 | 524 280 000 |
| Pêche côtière vivrière | 1999 | n/d | n/d |
| | 2007 | 3 500 | 1 372 000 000 |
| | 2014 | 3 500 | 1 660 000 000 |
| | 2021 | 4 760 | 2 568 972 000 |
| Pêche hauturière locale | 1999 | n/d | n/d |
| | 2007 | 2 122 | 745 000 000 |
| | 2014 | 2 876 | 1 316 600 000 |
| | 2021 | 2 625 | 1 846 000 000 |
| Pêche hauturière étrangère | 1999 | n/d | n/d |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Pêche en eau douce | 1999 | n/d | n/d |
| | 2007 | 10 | 3 992 000 |
| | 2014 | 10 | 4 743 000 |
| | 2021 | 10 | 5 397 000 |
| Aquaculture | 1999 | n/d | n/d |
| | 2007 | 1 931 | 1 443 700 000 |
| | 2014 | 1 733 | 1 843 500 000 |
| | 2021 | 1 538 | 2 088 000 000 |

Source : présente étude, Gillett (2016), Gillett (2009a), Gillett et Lightfoot (2001)

Les variations de la production que l'on constate entre ces quatre années correspondent pour partie à une véritable évolution de la production, mais peuvent également s'expliquer par l'adoption d'une méthode nouvelle (dont on peut espérer qu'elle constitue une amélioration) de mesure de cette même production. Dans le tableau ci-dessus, les niveaux de la production des pêches côtière professionnelle, côtière vivrière et d'eau douce restent pratiquement inchangés entre certaines années, car il n'existe pas de nouveaux chiffres ou de données empiriques pointant un changement. La variation de la production de la pêche côtière vivrière entre 2014 et 2021 correspond à un changement de méthode (réalisation de nouvelles études) plutôt qu'à une véritable évolution de la production. À l'inverse, l'évolution des chiffres de la pêche hauturière et de l'aquaculture (obtenus à partir de données de meilleure qualité) correspond à des variations réelles dans les volumes produits.

## A4.2 Contribution de la pêche au PIB (Produit intérieur brut)

### Contribution officielle actuelle

L'année 2017 est la dernière pour laquelle on dispose d'informations détaillées sur la part du secteur de la pêche dans le PIB. Il ressort de données non publiées de l'Institut de la statistique et des études économiques (ISEE) que pour cette année :

- La valeur de la production du secteur de la pêche s'est établie à 6,317 milliards de francs CFP.
- La consommation intermédiaire du secteur se chiffrait à 4,197 milliards de francs CFP.
- La valeur ajoutée (contribution du secteur au PIB) était donc de 2,120 milliards de francs CFP.
- Le PIB pour 2017 s'élevant à 862,551 milliards de francs CFP, la contribution du secteur de la pêche était de 0,2 % du PIB (2,120/862,551).

### Méthode de calcul de la contribution officielle de la pêche au PIB

Il ressort d'informations communiquées par l'ISEE (E. Desmazures, communication personnelle, janvier 2023), que la méthode employée est la suivante :

- Pour la crevetticulture et la pêche hauturière, les données relatives à la production et à la valeur ajoutée sont connues, car issues des documents comptables des entreprises.
- Pour la pêche professionnelle et non professionnelle, on utilise des données reprises de Gillett (2006) et d'autres études.

Les données ainsi définies font ensuite l'objet du traitement en quatre étapes décrit dans la section précédente.

## Autre formule de calcul de la contribution de la pêche au PIB

Le tableau A4-6 ci-dessous présente une méthode différente de celle qui est actuellement utilisée pour calculer la contribution de la pêche au PIB de la Nouvelle-Calédonie. Il s'agit d'une approche simplifiée de la production consistant à prendre en compte les cinq types d'activités de pêche/aquaculture dont la valeur de la production a été établie à la section A4.1 ci-dessus (et récapitulée au tableau A4-4), et à déterminer la valeur ajoutée à l'aide de coefficients correspondant au type de pêche concerné. Ces coefficients sont établis sur la base de la connaissance du secteur halieutique et d'études spécialisées (Appendix 3).

**Tableau A4-6 :** Contribution de la pêche au PIB en 2021 calculée au moyen d'une autre méthode

| Secteur de production | Valeur brute de la production (en francs CFP, reprise du tableau A4-4) | Coefficient de valeur ajoutée | Valeur ajoutée (francs CFP) |
|---|---|---|---|
| Pêche côtière professionnelle | 524 280 000 | 0,65 | 340 782 000 |
| Pêche côtière vivrière | 2 568 972 000 | 0,80 | 2 055 177 600 |
| Pêche hauturière locale | 1 846 000 000 | 0,20 | 369 200 000 |
| Pêche en eau douce | 5 397 000 | 0,90 | 4 857 300 |
| Aquaculture | 2 088 000 000 | 0,40 | 835 200 000 |
| **Total (francs CFP)** | **7 032 649 000** | **0,51** | **3 605 216 900** |

Source : tableau A4-4 et estimations du consultant

Il ne s'agit pas de substituer la méthode illustrée au tableau A4-6 à la méthode officielle, mais d'utiliser les résultats obtenus à titre de comparaison, afin de mieux évaluer la pertinence et la précision de la méthode en place, et de détecter d'éventuels ajustements à y apporter.

Le PIB de la Nouvelle-Calédonie s'élevant à 1 016 milliards de francs CFP en 2021 (site Internet de l'ISEE), la part de la pêche et de l'aquaculture (détaillée dans le tableau ci-dessus) correspond à 0,36 % du total.

On ne peut raisonnablement comparer la contribution de la pêche au PIB en 2021 calculée dans la présente étude (0,35 *%) avec la contribution officielle pour l'année 2017 présentée dans la section ci-dessus* (0,2 %). Il convient toutefois de noter que l'écart substantiel entre ces deux chiffres trouve probablement son origine dans les coefficients de valeur ajoutée appliqués. Le coefficient global de valeur ajoutée appliqué pour l'année 2017 à l'ensemble du secteur de la pêche est de 0,33 (2,120/6,317), contre 0,51 (3,605/7,032) pour 2021, comme on peut le voir dans le tableau ci-dessus établi aux fins de la présente étude. L'ISEE ayant accès aux documents comptables des entreprises des filières de la pêche hauturière et de la crevetticulture, il est probable que la différence entre la contribution de la pêche au PIB calculée dans la présente étude et le chiffre officiel résulte des coefficients de valeur ajoutée appliqués aux pêcheurs côtiers professionnels et non professionnels.

## A4.3 Exportations des produits de la mer

L'ISEE recense les exportations de la Nouvelle-Calédonie, dont celle de la filière halieutique. Ces données sont reproduites aux tableaux A4-7 et A4-8 qui présentent respectivement le volume et la valeur des exportations.

**Tableau A4-7 :** Volume des exportations de produits halieutiques de Nouvelle-Calédonie (tonnes)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Produits de la mer et de l'aquaculture | 1 326 | 1 262 | 1 343 | 1 446 | 1 342 | 1 150 |
| Thons | 418 | 407 | 391 | 477 | 407 | 525 |
| Crevettes | 807 | 770 | 797 | 887 | 878 | 566 |
| Holothuries | n/d | 66 | 46 | 37 | 21 | 13 |
| Trocas | 88 | 10 | 85 | 18 | 18 | 18 |
| Autres produits de la mer et de l'aquaculture | 14 | 9 | 24 | 27 | 18 | 28 |
| Total des exportations de la Nouvelle-Calédonie | 5 821 433 | 6 663 944 | 7 080 537 | 7 581 333 | 8 774 455 | 8 272 208 |
| Part des produits de la mer et de l'aquaculture dans les exportations (%) | 0,02 % | 0,02 % | 0,02 % | 0,02 % | 0,02 % | 0,01 % |

Source : adapté du site Internet de l'ISEE. Unité : tonnes

Tableau A4-8 : Valeur des exportations de produits halieutiques de Nouvelle-Calédonie (millions de francs CFP)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Produits de la mer et de l'aquaculture | 1,569 | 1,939 | 1,949 | 2,067 | 1,897 | 1,313 |
| Thons | 221 | 197 | 189 | 260 | 225 | 270 |
| Crevettes | 1 297 | 1 244 | 1 305 | 1 434 | 1 459 | 878 |
| Holothuries | n/d | 491 | 405 | 335 | 200 | 139 |
| Trocas | 42 | 5 | 32 | 8 | 6 | 8 |
| Autres produits de la mer et de l'aquaculture | 8 | 3 | 11 | 31 | 7 | 18 |
| Total des exportations de la Nouvelle-Calédonie | 144 447 | 167 108 | 196 527 | 182 255 | 180 367 | 185 894 |
| Part des produits de la mer et de l'aquaculture dans les exportations | 1.1% | 1.2% | 1.0% | 1.1% | 1% | 0.7% |

Source : adapté du site Internet de l'ISEE Unité : millions of francs CFP

La part très limitée des produits halieutiques dans le volume total des exportations s'explique par le volume considérable des exportations de produits du nickel, dont la valeur est par ailleurs relativement faible.

La lecture des tableaux ci-dessus montre que la crevette arrive largement en tête des produits de la mer et que le volume de ces exportations a progressé régulièrement jusqu'en 2021, année marquée par une réduction de la demande mondiale sous l'effet de la pandémie de COVID-19. Par le passé, l'holothurie se situait en deuxième position en valeur des exportations des produits de la mer, mais, depuis 2020, elle a rétrogradé au troisième rang, derrière le thon.

Contrairement à ce que l'on constate dans d'autres États et Territoires insulaires océaniens dotés d'une flottille locale de palangriers, l'essentiel des prises de la pêche hauturière de Nouvelle-Calédonie est consommé sur place et non pas exporté. En 2021, 80 % de ces captures étaient destinées au marché local (Anon. 2022b), la proportion étant proche de 50 % pour les crevettes (IEOM 2019).

Le tableau A4-9 extrait d'Anon. (2022a) détaille la destination des captures des palangriers en 2020, dernière année pour laquelle on dispose actuellement de données économiques.

Tableau A4-9 : Destination de la production de la pêche hauturière en 2020

| | Thon | | | Marlin | | | Autres espèces | | |
|---|---|---|---|---|---|---|---|---|---|
| Marché | Local | Exportation | | Local | | Exportation | Local | | Exportation |
| % | 80 % | 20 % | | 94 % | | 6 % | 100 % | | 0 % |
| État | Frais | Frais | Congelé | Frais | Congelé | Frais | Frais | Congelé | Frais |
| % | 100 % | 51 % | 49 % | n/d | n/d | 100 % | n/d | n/d | - |
| Tonnes | 1 755 | 447 | | 109 | | 6 | 123 | | - |

n/d – non disponible

# A4.4 Recettes publiques tirées de la pêche

## Droits d'accès acquittés par les flottilles de pêche étrangères

Depuis le début 2001, aucune licence de pêche n'a été délivrée à des navires de pêche étrangers (Anon. 2022b). Aucune redevance n'a donc été perçue à ce titre. La flottille locale n'est assujettie à aucun droit d'accès.

## Autres recettes publiques issues de la pêche

De manière générale, le secteur de la pêche de Nouvelle-Calédonie n'est pas producteur de recettes, mais plutôt consommateur de subventions publiques variées.

Une des plus populaires d'entre elles concerne le carburant des navires de pêche. Fabry et Laplante (2022) indiquent qu'en 2020, cette aide a été perçue par 168 bénéficiaires, pour un volume total de 556 999 litres de carburant et un coût de 33 millions de francs CFP. Selon IEOM (2019), le montant des aides versées au secteur de la crevetticulture par quatre organismes publics s'élevait à 300 millions de francs CFP.

# A4.5 Emplois associés au secteur de la pêche

Le bilan statistique annuel de la pêche côtière professionnelle de Nouvelle-Calédonie (Fabry et Laplante, 2022) détaille le nombre et les catégories de pêcheurs, ainsi que leur lieu de résidence (tableau A4-10). On y apprend également que :

- 75 % des pêcheurs répertoriés dans le tableau sont des hommes et 25 %, des femmes.
- L'âge médian est de 52 ans pour les deux sexes.

Tableau A4-10 : Nombre et catégories de pêcheurs déclarés à la pêche côtière professionnelle en 2020

| Province | Patrons-pêcheurs embarqués | Patrons-pêcheurs à pied | Matelots | Total pêcheurs |
|---|---|---|---|---|
| Province Sud | 130 | 0 | 75 | 205 |
| Province Nord | 246 | 45 | | 291 |
| Province des Îles Loyauté | 47 | 0 | | 47 |
| **Total** | **423** | **45** | **75** | **543** |

Unité = nombre de personnes

On dispose de très peu d'informations sur le nombre de personnes qui pratiquent la pêche vivrière en Nouvelle-Calédonie. Virly (2000) présente les résultats d'une enquête réalisée il y a plusieurs années, sur la base d'un questionnaire rempli par un échantillon de 1 000 personnes réparties entre les trois provinces du Territoire et qui montrait que la moitié des personnes interrogées pêchait une à trois fois par semaine. Un rapport sur l'état général de la filière pêche en Nouvelle-Calédonie (Auclair Dupont 2022) indique le pourcentage de ménages pratiquant la pêche (sans doute en majeure partie vivrière) dans chacune des régions de la Nouvelle-Calédonie : ils sont 17 % dans l'agglomération du Grand Nouméa, 28 % dans le nord-ouest du Territoire, 27 % dans le nord-est, 32 % dans le sud-est, 26 % dans le sud-ouest rural et 27 % dans les îles Loyauté.

Une publication de la Direction des affaires maritimes (DAM 2019) fournit des informations sur les effectifs de la flottille palangrière de Nouvelle-Calédonie (tableau A4-11). Les résultats d'une précédente étude sur les emplois de la filière hauturière (DAM 2014) montrent que l'on compte pratiquement autant de postes à terre (gestion des navires, traitement et vente en gros du poisson) qu'à bord des navires.

Tableau A4-11 : Nombre de personnes employées sur les palangriers

| Province | 2016 | 2017 | 2018 |
|---|---|---|---|
| Province des îles Loyauté | 4 | 4 | 4 |
| Province Nord | 18 | 15 | 21 |
| Province Sud | 93 | 142 | 168 |
| **Total Nouvelle-Calédonie** | **111** | **157** | **189** |

Pour ce qui concerne la filière aquacole, le site Internet de l'Agence rurale (www.agence-rurale.nc) indique que l'on dénombre dans le secteur de la crevette 244 salariés dans les bassins et les fermes et 306 salariés dans les ateliers. Il ressort d'une étude sur la crevetticulture en Nouvelle-Calédonie (IEOM 2019) que ce type d'aquaculture représente 1 % des emplois du secteur privé sur le Territoire.

Une étude réalisée en 2013 montre que, malgré la relative jeunesse de la population néo-calédonienne, les pêcheurs du Territoire vieillissent, ce qui pourrait être symptomatique d'un manque d'attractivité de la filière. En Province Nord, l'âge moyen des pêcheurs était de 53,5 ans, contre 50 ans en Province Sud (CNPMEM 2013).

## A4.6 Niveaux de consommation de la ressource halieutique

La consommation de poisson en Nouvelle-Calédonie a fait par le passé l'objet d'un certain nombre d'études dont on peut retenir les éléments suivants :

- Dupont et al. (2004) indiquent qu'en 2003, les foyers de Nouvelle-Calédonie ont consommé 4 632 tonnes de poisson et de crustacés, ces produits provenant aussi bien de la pêche locale que des importations. La consommation annuelle de poisson et de crustacés par habitant était estimée à 21,6 kg.
- Bell et al. (2009b) ont exploité les données issues des enquêtes sur les revenus et les dépenses des ménages réalisées entre 2001 et 2006 pour procéder à une estimation des modes de consommation du poisson dans les pays océaniens. Ces enquêtes avaient été conçues pour déterminer la part de la consommation attribuable respectivement aux produits de la pêche vivrière et aux achats en espèces. Pour l'ensemble de la Nouvelle-Calédonie, la consommation annuelle de poisson par habitant (poids entier équivalent) s'élevait à 25,6 kg. Elle était estimée à 54,8 kg dans les zones rurales contre 10,7 kg en zone urbaine.

Un rapport sur l'état général de la filière pêche en Nouvelle-Calédonie (Auclair Dupont 2022) détaille la consommation hebdomadaire de poisson des ménages pratiquant la pêche. En 2017, on recensait sur le territoire 17 034 ménages de pêcheurs, contre 68 029 ménages ne pratiquant pas cette activité. En 2017, la consommation hebdomadaire de poisson des ménages pratiquant la pêche dans les différentes zones du Territoire se déclinait comme suit : Grand Nouméa : 5,7 kg ; nord-ouest du Territoire : 8,7 kg ; nord-est : 11,2 kg ; sud-est rural : 12,5 kg ; sud-ouest rural : 6,0 kg et îles Loyauté : 8,6 kg, pour une moyenne de 7,1 kg pour l'ensemble des foyers du Territoire.

La consommation locale de poisson est alimentée par des productions relativement récentes. La pêche à la palangre a fait son apparition à Nouméa au début des années 80, et en 2021, les 18 palangriers locaux détenteurs d'une licence ont débarqué 2 626 tonnes de thon et autres poissons pélagiques (Anon. 2022b). Cette année-là, près de 80 % des captures de la pêche hauturière étaient destinées au marché local, ce qui correspond à 6,7 kg de poisson par an pour chacun des 273 674 résidents du Territoire. De la même manière, la moitié environ des 1 460 tonnes de crevettes produites en 2021 ont été absorbées par le marché local, soit de 2,7 kg par résident et par an.

Un rapport de l'Observatoire des pêches côtières (OPC 2022) cite une étude de 2016 qui indiquait que la population de Nouvelle-Calédonie consommait 8 700 tonnes de poissons lagonaires par an, soit 31,8 kg pour chacun des 273 674 résidents du Territoire.

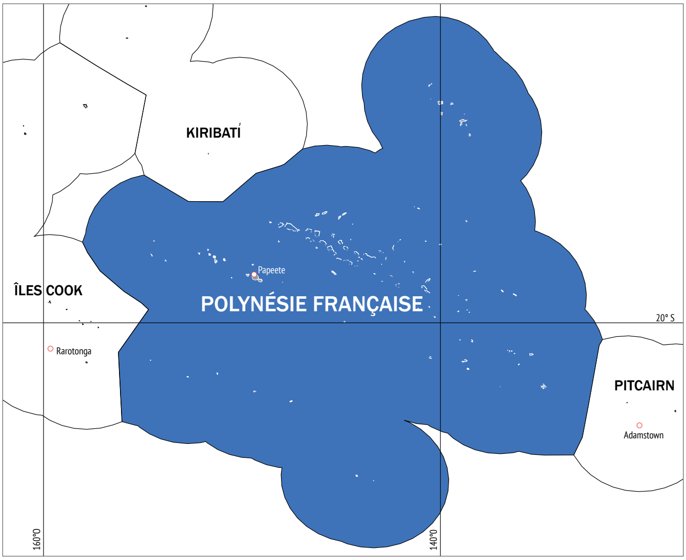
Si l'on ajoute à ces 31,8 kg le chiffre de la consommation individuelle de poisson pélagique indiquée ci-dessus (6,7 kg) ainsi que celui des crevettes (2,7 kg), on obtient une moyenne annuelle par habitant de 41,2 kg. Il est intéressant de constater que ce total est supérieur de 61 % à celui de la consommation annuelle de poisson par habitant en Nouvelle-Calédonie établie par Bell et al. (2009b) et indiquée ci-dessus.

## A4.7 Taux de change

Les taux de change annuels moyens (franc CFP en dollar É.-U.) utilisés dans le présent ouvrage sont les suivants :

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 89,88 | 86,01 | 98,13 | 108,81 | 114,17 | 99,42 | 104,39 | 106,78 | 98,00 | 105,37 | 120,27 |

# Appendix 5: Polynésie française




## A5.1 Volume et valeur de la production halieutique de Polynésie française

### Captures de la pêche côtière professionnelle de Polynésie française

La Direction des ressources marines (DRM) est le service des pêches de Polynésie française. Elle considère que la pratique de la pêche sur le Territoire se compose de trois catégories : pêche lagonaire, côtière et hauturière. Dans cette classification, la pêche dite « côtière » ne correspond pas à la définition adoptée aux fins de la présente étude : la DRM fait en effet entrer dans cette catégorie la pêche pratiquée en haute mer par des embarcations de taille relativement modeste. Conjointement, les catégories de la pêche lagonaire et de la pêche côtière de la DRM correspondent à la combinaison des catégories de la pêche côtière professionnelle et de la pêche côtière vivrière des études Benefish.

La pêche côtière pratiquée en Polynésie française a déjà fait l'objet de plusieurs études par le passé :

- Dalzell et al. (1996) ont estimé la production de la pêche côtière professionnelle à 2 352 tonnes (ce qui équivaut à 14 371 469 dollars É.-U.) et celle de la pêche côtière vivrière à 3 691 tonnes (pour une valeur de 14 468 720 dollars É.-U.).

- En 2009, après avoir exploité les données disponibles en les adaptant aux catégories sélectionnées pour sa propre étude, Gillett (2009a) a estimé que la production de la pêche côtière professionnelle de Polynésie française en 2007 s'établissait à 4 002 tonnes, soit une valeur départ pêcheur de 2 milliards de francs CFP.
- Sur la base d'estimations antérieures et après avoir pris en compte certains facteurs récents susceptibles d'avoir influé sur la production halieutique côtière (prises des palangriers, amélioration des services de fret aérien, par exemple), Gillett (2016) a estimé qu'en 2014 la production de la pêche côtière professionnelle de Polynésie française (correspondant aux prises des pêcheurs professionnels pratiquant la « pêche lagonaire » et la « pêche côtière » selon les définitions de la DRM) s'établissait à 5 666 tonnes, soit une valeur départ pêcheur de 3 052 588 235 francs CFP.

On peut lire dans le Bulletin statistique de la DRM (DRM 2022a) qu'en dépit de l'absence de données fiables sur les produits lagonaires, il est possible d'estimer la production globale polynésienne pour l'année 2021 à 4 300 tonnes, dont 3 400 tonnes de poissons lagonaires, 700 tonnes de petits pélagiques et 200 tonnes d'autres produits (mollusques, crustacés, échinodermes, etc.) pour une valeur départ pêcheur de l'ordre de 2 milliards de francs CFP. Compte tenu de l'expertise considérable de la DRM dans le domaine de la pêche, les auteurs de la présente étude ne contestent pas cette estimation, mais constatent qu'elle figure depuis de nombreuses années dans les bulletins de la DRM[1]. Pour évaluer la production de la pêche côtière professionnelle pour l'année 2021 à partir de cette estimation ancienne de la production lagonaire par la DRM, on peut logiquement procéder de la manière suivante :

- Augmenter la valeur des prises sur la base des valeurs de 2021
- Ventiler l'estimation de la DRM entre ses composantes professionnelle et vivrière
- Ajouter le volume et la valeur des prises des bonitiers et des poti marara (à savoir la « pêche côtière »)
- Procéder à certains ajustements pour tenir compte des facteurs susceptibles d'avoir récemment influé sur les prises de la pêche lagonaire.

Au cours des 13 années écoulées depuis le recueil des données sur lesquelles se fondent les estimations de la production de la pêche lagonaire de la DRM, les prix ont considérablement augmenté. Selon des données non publiées de l'Institut de la statistique de la Polynésie française (ISPF), les prix du poisson en général ont progressé de l'ordre de 20 % au cours de la période en question.

[1] Elle est reproduite à l'identique dans l'édition de 2009 du Bulletin statistique.

Dans le cadre de la présente étude et de celle de Gillett (2016), il a été signalé par des responsables de la DRM que la part de la production lagonaire commercialisée avait augmenté et atteignait désormais un niveau quasiment équivalent à celui des captures de la pêche vivrière (A. Stein, communication personnelle, septembre 2015 ; C. Ponsonnet, communication personnelle, décembre 2022).

Le tableau A5-1 présente le volume et la valeur des prises des bonitiers et des poti marara pour 2021, établis à partir des données de capture de la DRM (2022a) et de données sur les prix non publiées de l'ISPF.

**Tableau A5-1 :** Volume et valeur des prises des bonitiers et des poti marara.

| Espèces | Prises totales (tonnes) | Prix à la première vente (francs CFP/kg) | Valeur totale (francs CFP) |
|---|---|---|---|
| Bonite | 391 | 500 | 195 500 000 |
| Thon jaune | 887 | 600 | 532 200 000 |
| Mahi-mahi | 160 | 850 | 136 000 000 |
| Marlin | 239 | 500 | 119 500 000 |
| Thazard | 55 | 425 | 23 375 000 |
| Germon | 275 | 600 | 165 000 000 |
| Autres | 169 | 450 | 76 050 000 |
| **Total** | **2176** | | **1 247 625 000** |

La pandémie de COVID-19 a eu une incidence majeure sur le volume et la valeur des prises de la pêche lagonaire en Polynésie française. Une bonne part de la pêche lagonaire professionnelle du Territoire est pratiquée dans les lagons de l'archipel des Tuamotu, la production étant exportée par voie maritime vers les marchés de Tahiti. La DRM (2022a) estime à 691 tonnes le volume des produits lagonaires ainsi échangés. Pendant la pandémie, la diminution des liaisons avec Tahiti a entraîné un très fort ralentissement de la pêche lagonaire professionnelle aux Tuamotu. On notera également que la commercialisation à Tahiti des captures des palangriers qui y ont leur port d'attache peut entraîner une réduction de la demande des espèces lagonaires. Si la production de cette flottille n'a pas régressé pendant la pandémie, les exportations ont été en revanche freinées par l'absence de liaisons aériennes avec l'étranger, ceci entraînant une forte augmentation de l'offre des prises palangrières sur le marché de Tahiti.

Au nombre des autres facteurs influant sur la pêche lagonaire sur le Territoire, il faut citer la perliculture. Les fluctuations de la production des exploitations perlicoles (dont la plupart se trouvent aux Tuamotu) se font ressentir sur le niveau de la production halieutique, puisqu'il n'existe pratiquement pas d'autre secteur pourvoyeur d'emplois dans cette région. Selon la DRM (2022a), on compte en 2021 pratiquement autant de producteurs de perles de culture déclarés qu'en 2008.

D'autres facteurs ont eu une incidence sur la valeur de la pêche côtière professionnelle, même s'ils sont moins prégnants. C'est ainsi que les exportations de produits d'aquariophilie ont atteint un niveau record en 2021 (50,7 millions de francs CFP, valeur FAB), alors qu'on n'a enregistré aucune exportation d'holothuries au cours de cette même année.

Le tableau A5-2 est établi à partir de certaines des données présentées ci-dessus.

**Tableau A5-2 :** Estimation du volume et de la valeur des prises des pêcheurs professionnels en Polynésie française en 2021

| | Volume (tonnes) | Valeur (francs CFP) | Observations |
|---|---|---|---|
| Totalité de la pêche lagonaire selon les estimations de la DRM (2008), reprises dans DRM (2022a) | 4 300 | 2 000 000 000 | |
| Pêche professionnelle lagonaire (50 % de la totalité) | 2 150 | 1 000 000 000 | Sachant que la part de la production lagonaire commercialisée atteint désormais un niveau quasiment équivalent à celui des captures de la pêche vivrière |
| Ajustement correspondant à l'augmentation du prix du poisson entre 2008 et 2021 | --- | 1 200 000 000 | Les données de l'ISPF font apparaître une augmentation voisine de 20 % au cours de la période comprise entre 2008 et 2021 |
| Ajustement des volumes pour tenir compte de la récente conjoncture | Moins 325 | --- | Principalement à cause de la pandémie de COVID-19 |
| Prises des bonitiers et des poti marara en 2021 | 1 740 | 998 100 000 | En partant de l'hypothèse que 80 % des prises sont réalisées par des pêcheurs professionnels |
| **Total** | **3 565** | **2 198 100 000** | |

On peut estimer à quelque 3 565 tonnes la production de la pêche côtière professionnelle de Polynésie française en 2021, soit une valeur départ pêcheur de 2 198 100 000 francs CFP.

## Captures de la pêche côtière vivrière

Comme nous l'avons indiqué plus haut, la part de la pêche non professionnelle dans la production halieutique lagonaire (4 300 tonnes) est estimée à 2 150 tonnes. Pour déterminer la production totale de la pêche côtière vivrière, il importe de tenir compte des prises effectuées par les pêcheurs amateurs et « semi-professionnels » à l'extérieur du récif. Ces captures ne font pas l'objet d'un suivi statistique officiel, mais on peut les estimer à plusieurs centaines de tonnes (A. Stein, communication personnelle, décembre 2015). Aux fins de la présente étude, nous considérons que les prises de la pêche de loisir sont destinées à l'autoconsommation et relèvent donc de la pêche vivrière.

La production totale de la pêche côtière vivrière de la Polynésie française en 2021 est estimée à 2 350 tonnes, pour une valeur de 1 014 270 546 francs CFP calculée sur la base du prix à la production.

## Captures des unités de pêche hauturière locales

En 2021, la flottille de la pêche hauturière de Polynésie française était composée de 73 palangriers thoniers (mesurant de 13 à 24 m), pêchant uniquement dans la zone économique exclusive du Territoire. Les tailles de ces navires sont détaillées au tableau A5-3.

**Tableau A5-3 :** Classes de taille des unités de la pêche hauturière en 2021

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| 00-50 TJB | 34 | 37 | 37 | 36 | 37 |
| 51-200 TJB | 27 | 29 | 32 | 36 | 36 |
| 201-500 TJB | 0 | 0 | 0 | 0 | 0 |
| 500+ TJB | 0 | 0 | 0 | 0 | 0 |
| **Nombre total de navires** | **61** | **66** | **69** | **72** | **73** |

Source : DRM (2022b)

Le rapport annuel de la Polynésie française au Comité scientifique de la Commission des pêches du Pacifique occidental et central (DRM 2022b) détaille les prises des palangriers locaux (tableau A5-4).

Tableau A5-4 : Captures de la flottille locale de palangriers 2017-2021

| | 2017 | 2018 | 2019 | 2020 | | 2021 | |
|---|---|---|---|---|---|---|---|
| | | | | Embarquées | Rejetées | Embarquées | Rejetées |
| Germon | 2 148 | 3 058 | 3 393 | 2 780 | 31 | 2662 | 27 |
| Thon obèse | 897 | 1 063 | 934 | 855 | 16 | 1020 | 25 |
| Thon rouge du Pacifique | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bonite | 37 | 31 | 14 | 14 | 40 | 13 | 66 |
| Thon jaune | 1 434 | 1 314 | 1 309 | 1 080 | 56 | 2219 | 131 |
| Makaire noir | 21 | 16 | 11 | 18 | 0 | 18 | 2 |
| Marlin bleu | 163 | 224 | 274 | 240 | 7 | 173 | 3 |
| Marlin rayé | 73 | 81 | 88 | 97 | 2 | 128 | 1 |
| Espadon | 150 | 219 | 168 | 162 | 15 | 172 | 2 |
| **Total** | **4 923** | **6 006** | **6 191** | **5 245** | **168** | **6405** | **257** |

En 2021, le volume total des prises débarquées s'élevait à 6 405 tonnes. Le germon, le thon jaune et le thon obèse constituaient 87 % de la production commerciale totale. Le thazard, le marlin bleu, l'espadon et le marlin rayé étaient, par ordre d'importance décroissante, les principales espèces représentées dans les prises autres que les thons.

En temps normal, les exportations annuelles de la pêche palangrière correspondent à environ un tiers des prises débarquées, le solde étant destiné à la consommation locale. Comme nous l'avons indiqué plus haut, au cours de la pandémie de COVID-19, la production des palangriers n'a que légèrement reculé, mais les exportations ont été freinées par la réduction des liaisons aériennes avec l'étranger, ce qui a entraîné une forte augmentation de l'offre des prises palangrières sur le marché de Tahiti.

Sur la base d'un prix moyen à la première vente de 700 francs CFP/kg pour les trois espèces de thons et de 600 francs CFP/kg pour les autres espèces, la valeur des 6 405 tonnes de captures de la flottille palangrière s'établit en 2021 à 4 434 400 000 francs CFP (4 139 800 000 francs CFP + 294 600 000 francs CFP).

## Captures des unités de pêche hauturière battant pavillon étranger

Depuis décembre 2020, aucun navire battant pavillon étranger ne pratique plus légalement la pêche dans la zone économique exclusive de la Polynésie française.

## Captures en eau douce

Keith *et al.* (2002) ont étudié les poissons et les crustacés d'eau douce de Polynésie française et recensé 37 espèces de poissons et 18 espèces de crustacés décapodes sur le Territoire.

Les espèces présentant le plus d'intérêt pour la pêche sont les juvéniles de gobies (*Sicyopterus lagocephalus* et *S. pugnans*), les crevettes *Macrobrachium*, les tilapias, les *Kuhlia* et les anguilles. Il n'est procédé à aucune estimation officielle de la production de la pêche en eau douce sur le Territoire, mais des agents du Service de la pêche ayant une bonne connaissance du secteur indiquent que, nonobstant le caractère très fluctuant du volume des captures, on peut considérer qu'il s'élève en moyenne à 100 tonnes par an (A. Stein, communication personnelle, novembre 2015). Aucune évolution majeure de cette pêche n'a été constatée au cours des dix dernières années.

En employant une méthode analogue à celle utilisée pour la pêche côtière vivrière (voir ci-dessus), on peut estimer la valeur de ces 100 tonnes à 43 800 000 francs CFP.

## Production aquacole

En Polynésie française, l'aquaculture est dominée par la perliculture, mais les données relatives à la production des fermes perlicoles sont incomplètes, car la procédure de déclaration de la production et des exportations n'est pas toujours respectée. D'après le Bulletin statistique de la DRM (DRM 2022a), en 2021, la surface totale exploitée pour la perliculture était de 8 136 hectares, soit une baisse de 0,26 % par rapport à l'année précédente. L'archipel des Tuamotu représente 72 % de la surface exploitée. D'après IEOM (2022), la perliculture est pratiquée sur une quinzaine d'atolls de la Polynésie française. Sur les 8,5 millions de perles produites en 2021, 64 % provenaient des Tuamotu et 34 % des Gambier.

L'impact de la pandémie de COVID-19 sur la perliculture s'est principalement fait ressentir sur la commercialisation des perles. La forte limitation des ventes à l'international a entraîné la constitution de stocks importants, destinés à être écoulés ultérieurement.

Les estimations relatives à la production aquacole de la Polynésie française figurant dans la présente étude et dans le tableau A5-5 ci-dessous sont le résultat d'échanges multiples et approfondis avec la direction de la section aquaculture de la DRM.

**Tableau A5-5 :** Production de la filière aquacole de Polynésie française en 2021

| Produit | Volume | | Valeur à la production (francs CFP) | Notes |
|---|---|---|---|---|
| | Tonnes | Nombre d'unités | | |
| Perliculture | | | | |
| Perles | | 8 558 771 | 5 290 400 000 | Le volume indiqué correspond au nombre de « perles contrôlées » figurant à la page 35 de DRM (2022a). Les exportations de perles détaillées à la page 58 de DRM (2022a) comprennent un nombre substantiel de perles issues de stocks constitués au cours des années précédentes. On part de l'hypothèse d'un prix moyen à l'exportation de 282 francs CFP/gramme en 2021, auquel on applique un ajustement de 15 % pour obtenir un prix à la production de 240 francs CFP/gramme. Ce taux relativement faible par rapport à celui qui s'applique à d'autres produits aquacoles s'explique par le caractère non périssable des perles. |
| Nacre | 1 365 | | 176 000 000 | En partant de l'hypothèse que la valeur FAB de 176 millions de francs CFP figurant dans DRM (2022a) peut être ajustée de 25 % pour obtenir le niveau approximatif de la valeur à la production |
| Crevettes | 161,4 | | 342 168 000 | En partant de l'hypothèse d'un prix à la production de 2 120 francs CFP/kg |
| Bénitiers | | 15 241 | 4 500 000 | En partant de l'hypothèse que : a) la production correspond à l'ensemble des bénitiers de collectage (collecte de naissain) et d'écloserie figurant dans DRM (2022a), et b) la valeur FAB totale des exportations de bénitiers en 2021 s'élevait à 49,6 millions de francs CFP selon DRM (2022), dont 60 % (29,7 millions de francs CFP) de bénitiers d'élevage. Ce chiffre peut être ajusté de 85 % pour obtenir une valeur à la production approximative de 4,5 millions de francs CFP. |
| Platax orbicularis | 15,3 | | 33 660 000 | En partant de l'hypothèse d'un prix à la production de 2 200 francs wCFP/kg |
| **Total** | **1 541,7** | **8 574 012** | **5 846 503 000** | @114,6 = 51,3 millions de dollars des États-Unis |

Source : DRM (2022a) et informations aimablement communiquées par G. Remoissenet (communication personnelle, novembre 2022).

Outre les produits susmentionnés, les espèces suivantes sont élevées en Polynésie française (ou l'ont été dans un passé récent) à une échelle limitée ou expérimentale : holothuries, huîtres de roche, sunfish, tilapia (en aquaponie) et diverses algues.

La valeur totale de la production aquacole de Polynésie française en 2021 est estimée à 1 542 tonnes, auxquelles viennent s'ajouter 8 574 012 unités, pour une valeur à la production de 5 846 503 000 francs CFP.

## Synthèse des captures

Le tableau A5-6 présente une approximation du volume et de la valeur de la production de la pêche et de l'aquaculture en Polynésie française pour l'année 2021.

**Tableau A5-6 :** Production annuelle de la pêche et de l'aquaculture en Polynésie française, 2021

| | Volume (tonnes et nombre d'unités) | Valeur (francs CFP) |
|---|---|---|
| Pêche côtière professionnelle | 3 565 | 2 198 100 000 |
| Pêche côtière vivrière | 2 350 | 1 014 270 546 |
| Pêche hauturière locale | 6 405 | 4 434 400 000 |
| Pêche hauturière étrangère | 0 | 0 |
| Pêche en eau douce | 100 | 43 800 000 |
| Aquaculture | 1 542 t et 8 574 012 unités | 5 846 503 000 |
| **Total** | **13 962 t et 8 574 012 unités** | **13 537 073 546** |

Les figures A5-1 et A5-2 illustrent le volume et la valeur de la production halieutique en Polynésie française en 2021. L'aquaculture n'est pas représentée dans la figure consacrée au volume de la production en raison de l'utilisation de deux paramètres distincts (nombre d'unités et tonnes).

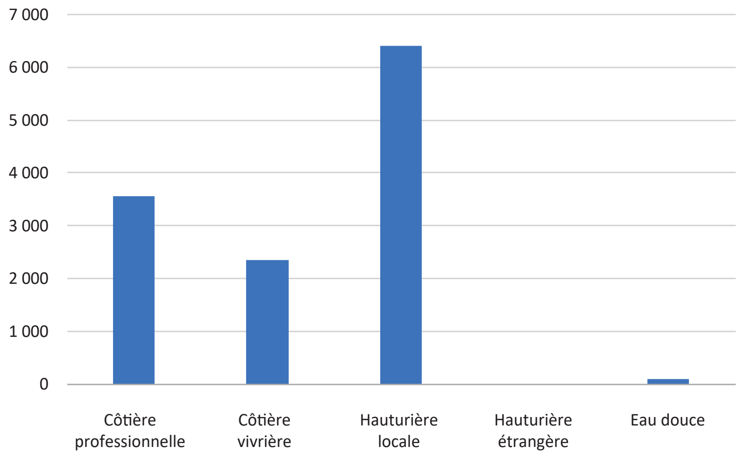



**Figure A5-1 :** Volume de la production halieutique de Polynésie française en 2021 (exprimé en tonnes)

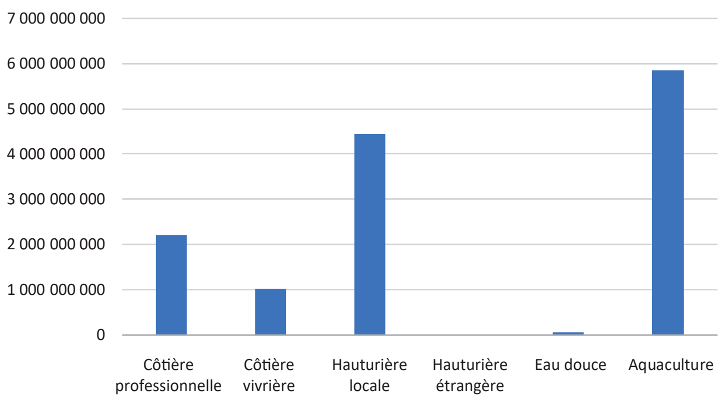



**Figure A5-2 :** Valeur de la production halieutique de Polynésie française en 2021 (exprimée en francs CFP)

## Estimation de la production halieutique dans les précédentes études Benefish

Un certain nombre d'études portant sur les retombées de la pêche dans les pays océaniens (Études Benefish) ont déjà été réalisées. Gillett et Lightfoot (2001) se sont intéressés à l'année 1999, Gillett (2009a) à 2007, Gillett (2016) à 2014, tandis que la présente publication porte sur l'année 2021. Les estimations de la production annuelle de la Polynésie française issues de ces études sont reproduites dans le tableau A5-7[2].

[2] L'étude Benefish la plus ancienne, réalisée par Gillett et Lightfoot (2001), ne prend en compte ni l'aquaculture, ni la pêche en eau douce, ni les Territoires non indépendants.

Tableau A5-7 : Estimations de la production annuelle de la pêche et de l'aquaculture issues des études Benefish

| | Année | Volume (tonnes et nombre d'unités, le cas échéant) | Valeur nominale (francs CFP) |
|---|---|---|---|
| Pêche côtière professionnelle | 1999 | n/d | n/d |
| | 2007 | 4 002 | 2 001 400 000 |
| | 2014 | 5 666 | 3 052 588 235 |
| | 2021 | 3 565 | 2 198 100 000 |
| Pêche côtière vivrière | 1999 | n/d | n/d |
| | 2007 | 2 880 | 1 149 120 000 |
| | 2014 | 2 350 | 1 125 171 000 |
| | 2021 | 2 350 | 1 014 270 546 |
| Pêche hauturière locale | 1999 | n/d | n/d |
| | 2007 | 6 308 | 2 457 515 000 |
| | 2014 | 5 390 | 2 829 000 000 |
| | 2021 | 6 405 | 4 434 400 000 |
| Pêche hauturière étrangère | 1999 | n/d | n/d |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Pêche en eau douce | 1999 | n/d | n/d |
| | 2007 | 100 | 42 500 000 |
| | 2014 | 100 | 47 879 616 |
| | 2021 | 100 | 43 800 000 |
| Aquaculture | 1999 | n/d | n/d |
| | 2007 | 56 | 10 762 600 000 |
| | 2014 | 101 t et 8 361 500 unités | 8 809 250 000 |
| | 2021 | 1542 t et 8 574 012 unités | 5 846 503 000 |

Les variations de la production que l'on constate entre ces quatre années de référence correspondent pour partie à une véritable évolution de la production, mais peuvent également s'expliquer par l'adoption d'une nouvelle méthode (dont on peut espérer qu'elle constitue une amélioration) pour mesurer cette même production. Si l'on en croit les chiffres figurant dans le tableau ci-dessus, les niveaux de production annuels de la pêche côtière professionnelle, côtière vivrière et d'eau douce ont beaucoup fluctué entre ces années : ces variations s'expliquent toutefois en partie par la méthode employée pour estimer la production. À l'inverse, il est probable que l'évolution des chiffres de la pêche hauturière et de l'aquaculture (obtenus à partir de données de meilleure qualité) corresponde à des changements réels dans les volumes prélevés.

## A5.2 Contribution de la pêche au PIB (Produit intérieur brut)

### Contribution officielle actuelle

D'après les agents de l'ISPF, le dernier calcul détaillé du PIB du Territoire concerne l'année 2018 (A. Ailloud, communication personnelle, décembre 2022). Selon ISPF (2022a), le PIB pour 2018 (à prix courants) s'établit à 626 899 000 000 francs CFP.

Il ressort de données non publiées de l'ISPF qu'en 2018 :

- La valeur ajoutée de la perliculture s'élevait à 3 915 000 000 francs CFP
- La valeur ajoutée de l'aquaculture hors perliculture et de la pêche s'établissait à 8 301 000 000 francs CFP
- La valeur ajoutée totale de l'aquaculture et de la pêche était de 12 216 000 000 francs CFP.

Le PIB s'établissant à 626 899 000 000 francs CPF en 2018, la valeur ajoutée totale de l'aquaculture et de la pêche équivalait à 1,95 % du PIB pour cette année.

### Méthode de calcul de la contribution officielle de la pêche au PIB

La méthode de calcul de la contribution de la pêche et de l'aquaculture au PIB se caractérise par les spécificités suivantes, mises en évidence par les agents de l'ISPF (A. Ailloud, communication personnelle, décembre 2022) :

- Le prix départ pêcheur correspond au prix de vente au détail divisé par 1,35 (dénominateur adopté par l'ISPF).
- L'année de référence actuellement utilisée pour la réalisation des estimations du PIB est 2005 et la méthode employée a peu évolué depuis (y compris pour le secteur de la pêche).
- La part de la perliculture dans le PIB est calculée séparément de celle des pêches lagonaire, côtière et hauturière, et de l'aquaculture hors perliculture.
- Le coefficient de valeur ajoutée appliqué à la perliculture est de 44,8 %.
- Le coefficient de valeur ajoutée appliqué à l'aquaculture hors perliculture et à la pêche est de 38,5 %.

La seule observation qui s'impose au sujet de la méthode décrite ci-dessus concerne le coefficient de valeur ajoutée appliqué à l'aquaculture hors perliculture ainsi qu'à la pêche. Il semble peu judicieux de recourir à un seul et unique coefficient pour tous les types de pêche (de la pêche palangrière industrielle à la petite pêche lagonaire). En définissant des coefficients spécifiques pour certains sous-secteurs, on pourrait sans doute obtenir des estimations plus pertinentes de la valeur ajoutée. On peut imaginer par exemple d'appliquer un coefficient de 0,90 à la pêche non motorisée et de 0,20 à la pêche à la palangre, au lieu d'un coefficient de valeur ajoutée de 38,5 % à une catégorie recouvrant ces deux activités.

## Autre formule de calcul de la contribution de la pêche au PIB

Le tableau A5-8 ci-dessous présente une méthode différente de celle qui est actuellement utilisée pour calculer la contribution de la pêche au PIB de la Polynésie française. Il s'agit d'une approche simplifiée de la production consistant à prendre en compte les cinq types d'activités de pêche/aquaculture dont la valeur de production a été établie à la section A5-1 ci-dessus (et récapitulée au tableau A5-6), et à déterminer la valeur ajoutée à l'aide de coefficients correspondant au type de pêche concerné, qui sont définis sur la base de la connaissance du secteur halieutique et d'études spécialisées (Appendix 3). Le coefficient de valeur ajoutée du secteur de la perliculture a été déterminé à la suite d'un examen des documents comptables d'exploitations perlicoles des Îles Cook et des Fidji.

Le tableau A5-8 ci-dessous porte sur l'année 2021, tandis que la dernière estimation de la contribution de la pêche au PIB du Territoire obtenue en ayant recours à la méthode officielle concerne l'année 2018.

Il ne s'agit pas de substituer la méthode illustrée au tableau A5-7 à la méthode officielle, mais d'utiliser les résultats obtenus à titre de comparaison, afin de mieux évaluer la pertinence et la précision de la méthode en place, et de détecter d'éventuels ajustements à y apporter.

Tableau A5-8 : Contribution de la pêche au PIB en 2021 calculée au moyen d'une autre méthode

| Type de pêche | Valeur brute de la production (en francs CFP, reprise du tableau A5-6) | Coefficient de valeur ajoutée | Valeur ajoutée (francs CFP) |
|---|---|---|---|
| Pêche côtière professionnelle | 2 198 100 000 | 0,55 | 1 208 955 000 |
| Pêche côtière vivrière | 1 014 270 546 | 0,70 | 709 989 382 |
| Pêche hauturière locale | 4 434 400 000 | 0,20 | 886 880 000 |
| Pêche en eau douce | 43 800 000 | 0,85 | 37 230 000 |
| Aquaculture | 5 846 503 000 | 0,45 | 2 630 926 350 |
| **Total (francs CFP)** | **13 537 073 546** | --- | **5 473 980 732** |

Ce tableau fait apparaître une contribution globale de la pêche et de l'aquaculture d'une valeur de 5,474 milliards de francs CFP en 2021. Dans la section ci-dessus, la contribution officielle pour l'année 2018 est estimée à 12,216 milliards de francs CFP. Cet écart s'explique en partie par l'application d'une méthode différente à une année au cours de laquelle la production de la pêche et de l'aquaculture a subi le contrecoup de la pandémie de COVID-19. Il est en outre possible qu'il résulte de l'application de coefficients de valeur ajoutée distincts. La comparaison de la valeur brute de la production des deux catégories (1) perliculture et 2) pêche lagonaire/côtière/hauturière, et aquaculture hors perliculture) reportée dans le tableau A5-8 ci-dessus avec celle qui est issue des données non publiées de l'ISPF, montre que les valeurs de la production fournies par l'ISPF sont beaucoup plus élevées pour les deux catégories. Aux yeux des auteurs de la présente étude, il est probable que les valeurs portées dans le tableau ci-dessus au titre de la catégorie # 2 sont plus proches de la réalité que les données de l'ISPF.

## A5.3 Exportations des produits de la mer

L'ISPF a produit des informations sur les exportations des produits de la mer hors perliculture à partir des données des services des douanes (tableau A5-9).

**Tableau A5-9 :** Exportations des produits de la mer hors perliculture de Polynésie française

| | 2020 | 2021 |
|---|---|---|
| Poissons du large | 782 | 1 685 |
| Entiers réfrigérés | 665 | 1 521 |
| Entiers congelés | 14 | 5 |
| Filets et chairs réfrigérés | 10 | 27 |
| Filets et chairs congelés | 93 | 132 |
| Poissons vivants | 28 | 51 |
| Mollusques, crustacés et autres invertébrés | 44 | 50 |
| Mollusques | 44 | 50 |
| Autres invertébrés | 0,2 | 0 |
| Crustacés | 0 | 0 |
| Coquilles | 190 | 186 |
| **Total** | **1 044** | **1 972** |

Source : ISPF (2022b). Unité = millions de francs CFP

On trouve dans le Bulletin statistique de la DRM des informations détaillées sur les exportations de perles de culture de Polynésie française (tableau A5-10).

**Tableau A5-10 :** Exportations de perles de culture

| | Volume (tonnes) | Valeur FAB (millions de francs CFP) |
|---|---|---|
| 2017 | 14,7 | 8 117 |
| 2018 | 12,4 | 7 463 |
| 2019 | 10,1 | 4 870 |
| 2020 | 8,9 | 2 380 |
| 2021 | 16,9 | 4 751 |

Source : DRM (2022a)

Les exportations de produits locaux se chiffrant en 2021 à 9,341 milliards de francs CFP (IEOM 2022a), la valeur des exportations des perles et autres produits de la mer (6,723 milliards de francs CFP) équivaut à 72 % du montant total pour cette année.

Les exportations des produits de la mer de Polynésie française présentent en outre les spécificités suivantes :

- À la différence de nombreux autres produits de la mer, il n'est pas aisé de suivre les exportations de produits perliers, car les producteurs ont souvent tendance à constituer des stocks lorsque la conjoncture est défavorable, de sorte que le rapport entre la production et les exportations annuelles est peu lisible.
- Il est arrivé que certaines années (2011 et 2012 par exemple), la valeur des exportations de ce produit dépasse la barre des 100 millions de francs CFP.
- Les poissons du lagon sont rarement exportés de Polynésie française en raison du risque ciguatérique.
- On peut lire dans IEOM (2022a) que les produits perliers constituent le premier produit local à l'export de la Polynésie française (53 % de la valeur totale), devant le poisson (19 %), l'huile de coprah (7 %) et la vanille (6 %).
- La pandémie de COVID-19 a entraîné une forte dégradation des exportations de la filière halieutique dont la plupart des produits ont pâti en 2020. Ils sont toutefois nombreux à avoir rebondi en 2021 (perles, produits d'aquariophilie, thon frais).

## A5.4 Recettes publiques tirées de la pêche

### Droits d'accès acquittés par les flottilles de pêche étrangères

Tous les accords d'accès contractés avec des flottilles de pêche étrangères sont arrivés à leur terme en décembre 2000 (DRM, 2022b). De ce fait, aucune redevance n'est plus perçue à ce titre. La flottille locale n'est assujettie à aucun droit d'accès.

### Autres recettes publiques issues de la pêche

De manière générale, le secteur de la pêche de Polynésie française est moins producteur de recettes que consommateur de subventions publiques. De nombreuses aides financières sont prévues pour les différents sous-secteurs de la pêche, sous forme par exemple d'aides à l'achat du carburant pour les palangriers ou de subventions pour la construction de bateaux de pêche côtiers.

Les exportations de perles sont assujetties à une taxe modique. Initialement fixée à 200 francs CFP par gramme, elle est passée à 50 francs CFP en 2009. Destinée à l'origine au financement de la promotion du secteur de la perle, cette taxe alimente désormais le budget général du Territoire. Selon certaines informations, son prélèvement aurait été assoupli pendant la pandémie de COVID-19.

## A5.5 Emplois associés au secteur de la pêche

Le Bulletin statistique de la DRM (DRM 2022a) offre un inventaire très complet de la production de la pêche et de l'aquaculture en Polynésie française. Il s'avère en revanche plus difficile de trouver des données relatives à la dimension socioéconomique de la pêche sur le Territoire. Le Bulletin indique que l'on dénombrait en 2021 un total de 1 110 pêcheurs professionnels pratiquant la pêche lagonaire (détenteur d'une « carte professionnelle de pêcheur lagonaire »).

L'étude sur le budget des familles de Polynésie française publiée en 2015 (ISPF non daté) ne contient aucune information permettant d'estimer le nombre de personnes ou de ménages pratiquant la pêche.

On peut lire dans la publication intitulée « Bilan de l'emploi en 2020 » (ISPF 2021) que les effectifs du secteur perlicole ont enregistré une diminution de 39 %, avec 590 emplois en 2020 contre 960 un an plus tôt. Une étude plus ancienne de l'ISPF consacrée à l'emploi en Polynésie française (ISPF 2015b) montre que les effectifs du secteur perlicole atteignaient 1 060 emplois en 2014. Il ressort également du « Bilan de l'emploi en 2020 » que l'emploi dans la pêche et l'aquaculture en eau douce s'est maintenu entre 2019 et 2020.

La CPS (2013) s'appuie sur les données issues d'enquêtes sur le terrain pour déterminer la proportion d'hommes et de femmes chez les pêcheurs en Océanie. Sur les sites étudiés en Polynésie française, on constate qu'environ 78 % des pêcheurs sont des hommes, contre 22 % de femmes.

## A5.6 Niveaux de consommation de la ressource halieutique

La consommation de poisson en Polynésie française a fait par le passé l'objet d'un certain nombre d'études dont on peut retenir les éléments suivants :

- En 2003, une analyse réalisée par le Service de la pêche (Service de la pêche, données non publiées) a conclu que chaque habitant du Territoire consommait annuellement un total de 31,4 kg de poisson. Ce résultat a été obtenu sur la base des estimations suivantes : Production locale de poisson : 9 102 tonnes, poids net. Importations de poisson : 790 tonnes. Exportations de poisson : 1 731 tonnes. Population : 259 596 habitants.

Dans cette analyse, la production de la pêche locale (poids vif) a été réduite de 30 %, probablement pour obtenir le poids effectif des aliments.

- Bell *et al.* (2009b) ont exploité les données issues des enquêtes sur les revenus et les dépenses des ménages réalisées entre 2001 et 2006 pour procéder à une estimation des modes de consommation du poisson dans les pays océaniens. Ces enquêtes avaient été conçues pour déterminer la part de la consommation attribuable respectivement aux produits de la pêche vivrière et aux achats en espèces. Pour l'ensemble de la Polynésie française, la consommation annuelle de poisson par habitant (poids entier équivalent) s'élevait à 70,3 kg, dont 82 % de poisson frais. Dans les zones rurales, elle était estimée à 90,1 kg dans les zones rurales, contre 52,2 kg en zone urbaine.
- Le Centre de recherche halieutique (Fisheries Centre) de l'Université de Colombie britannique a passé en revue (Bale et al. 2009) un certain nombre d'études relatives à la consommation de poisson en Polynésie française et appliqué les taux de consommation calculés en 2007 aux différents archipels du Territoire : zones rurales de Tahiti (19,3 kg/personne/an) ; îles de la Société hors Tahiti (43,7 kg/personne/an) ; îles Australes (43,7 kg/personne/an) ; Marquises (21,9 kg/personne/an) et Tuamotu/Gambier (150 kg/personne/an).

Il ressort du rapport établi par Alvea Consulting (2021) à partir d'une analyse des multiples facettes de la commercialisation et de la consommation du poisson à Tahiti que les ménages du Territoire consomment 789 tonnes de poissons du lagon, ce qui correspond à une moyenne de 73 kg (poids entier équivalent) par ménage et 20 kg par personne.

La présente étude a permis de déterminer la part de la production halieutique du territoire consommée localement (tableau A5-11).

Tableau A5-11 : Production halieutique locale destinée à la consommation locale

| Origine | Volume des captures destinées à la consommation locale (tonnes) | Observations |
|---|---|---|
| Pêche côtière professionnelle | 8 250 | Total des captures auquel on a soustrait les produits non comestibles et le faible volume des exportations |
| Pêche côtière vivrière | 2 350 | |
| Pêche hauturière locale | 4 000 | Production annuelle : 6 000 tonnes, dont 1/3 est exporté en temps normal (hors COVID) |
| Pêche en eau douce | 100 | |
| Aquaculture | 176 | Crevettes : 161 tonnes<br>*Platax orbicularis* : 15 tonnes |
| **Offre totale de poisson produite localement** | **14 876** | |

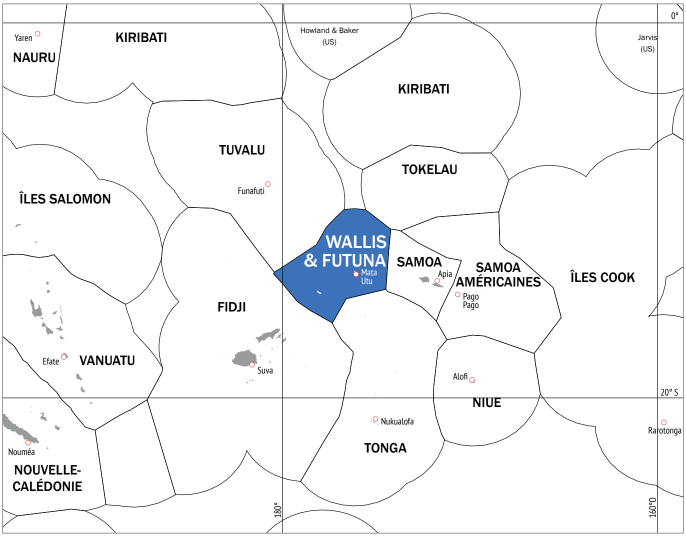
Sur la base d'une population de 280 000 habitants, ce volume de 14 876 tonnes équivaut à 53 kg de poisson (poids entier équivalent) par personne et par an. Ce chiffre ne prend en compte ni les importations ni le poisson consommé par les touristes.

## A5.7 Taux de change

Les taux de change annuels moyens (franc CFP en dollar É.-U.) utilisés dans la présente publication sont les suivants :

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 89,88 | 86,01 | 98,13 | 108,81 | 114,17 | 99,42 | 104,39 | 106,78 | 98,00 | 105,37 | 120,27 |

# Appendix 6: Wallis et Futuna




## A6-1 Volume et valeur de la production halieutique de Wallis et Futuna

### Captures de la pêche professionnelle côtière de Wallis et Futuna

L'encadré A6-1 présente un rapide tour d'horizon de la pêche à Wallis et Futuna.

**Encadré A6-1 :** La pêche à Wallis et Futuna

La pêche à Wallis et Futuna est exclusivement côtière, la quasi-totalité de l'effort de pêche se concentrant sur une bande s'étendant du récif frangeant à quelques milles marins du récif. De manière générale, les pêcheurs n'ont pas recours à des engins de pêche mécanisés. La plupart des embarcations sont de petite taille (entre 4 et 6 mètres) et sont équipées de moteurs hors-bord d'une puissance comprise entre 15 et 80 CV. Très peu de pêcheurs détiennent un GPS ou un sondeur et le matériel de sécurité est bien souvent absent. La plupart pratiquent la pêche au filet (50 %), la chasse sous-marine (44 %), la pêche à la traîne (21 %) ou encore à la palangrotte (26 %), et 35 % des pêcheurs pratiquent également le ramassage de coquillages et de crustacés. Toutes techniques confondues, les pêcheurs sortent une à deux fois par semaine pour une durée variant de 2 à 8 heures et ciblent un éventail très large d'espèces : les pêcheurs professionnels exploitent plus de 300 espèces de poissons et d'invertébrés (l'île de Wallis est exempte de risque ciguatérique). Environ 30 % de ces captures sont des thons et espèces associées.

La pratique de la pêche sur le Territoire a connu une transformation majeure ces dernières années. En comparant les résultats de deux enquêtes réalisées par le passé on constate qu'à Futuna, le nombre de bateaux a décliné, passant de 56 en 2001 à 36 en 2014. Il en a été de même à Wallis, où l'on comptait 252 embarcations en 2001, mais seulement 143 en 2014. Sur une période de 13 ans, on a donc enregistré une baisse de 42 % des effectifs de la flottille du Territoire.

Source : Jaugeon et Juncker (2021) et Sourd et Mailagi (2015)

La pêche côtière de Wallis et Futuna a déjà fait l'objet de plusieurs tentatives d'évaluation, dont voici quelques exemples :

- À partir des informations issues d'un rapport datant de 1994 sur l'économie de Wallis et Futuna et d'entretiens avec un agent du service de la pêche, Dalzell *et al.* (1996) ont estimé la production de la pêche côtière professionnelle à 296 tonnes (pour une valeur de 2 316 729 dollars É.-U.) et celle de la pêche côtière vivrière à 621 tonnes (ce qui correspond à 3 105 360 dollars É.-U.).
- En 2001, il a été procédé à un inventaire détaillé des pêcheurs, des engins de pêche et des pratiques halieutiques à Wallis et Futuna (Fourmy 2002), mais aucune estimation des prises n'a été réalisée.
- Gillett (2009a) a pris en compte plusieurs types de données relatives à la pêche côtière à Wallis et Futuna, dont les estimations de Dalzell *et al.* (1996), une enquête sur le budget des familles réalisée entre juin 2005 et mai 2006 auprès de 1 025 ménages (Buffière 2006), ainsi que les chiffres des exportations de produits halieutiques, pour conclure qu'en 2007, la production de la pêche côtière professionnelle à Wallis et Futuna s'était élevée à 121 tonnes, ce qui correspond à 105 millions de francs CFP.

- Sur la base de ces estimations, de l'évolution récente de la démographie et de l'économie et de la baisse du nombre de bateaux de pêche, Gillett (2016) a estimé que la production de la pêche côtière professionnelle à Wallis et Futuna en 2014 s'élevait à 150 tonnes, soit une valeur de 150 millions de francs CFP.

Le Territoire ayant été pratiquement coupé du monde pendant la première phase de la pandémie de COVID-19, le premier cas de cette maladie n'a été enregistré qu'en mars 2021 (IEOM 2022b). Cet isolement a entraîné des pénuries alimentaires et contribué en partie à une augmentation de la pratique de la pêche. Toutefois, d'après les agents de la Direction des services de l'agriculture, de la forêt et de la pêche (DSA), la pandémie n'a eu qu'un « effet détectable, mais mineur sur la pêche ».

Plusieurs éléments pointent une diminution de l'importance de la pêche à Wallis et Futuna au cours des dernières décennies. Dans son rapport annuel sur l'économie de Wallis et Futuna en 2021 (IEOM 2022b), l'Institut d'émission d'outre-mer cite l'enquête sur le budget des familles réalisée en 2019-2020 qui révélait que si en 2006, 35 % des ménages du Territoire pratiquaient la pêche vivrière, ce pourcentage n'était plus que de 9 % en 2019-2020. D'après les agents de la DSA, alors que l'on comptait environ 2 000 pêcheurs (pratiquant la pêche professionnelle et vivrière) en 2014, en 2021 ce chiffre était proche de 200. L'évolution des préférences alimentaires et l'augmentation des revenus monétaires ont entraîné une baisse de la consommation de poisson. D'après les données de la Division statistique pour le développement de la CPS, le Territoire a enregistré une baisse de sa population, qui est passée de 12 250 habitants en 2014 à 11 369 en 2021. Anon. (2022b) a déclaré que le Territoire avait perdu 22 % de sa population entre 2003 et 2018.

Depuis quelques années, on dispose de données supplémentaires sur la production halieutique de Wallis et Futuna issues de l'enquête sur le budget des familles de 2019, du suivi des débarquements des pêcheurs professionnels[1] et de leurs fiches de pêche. C'est notamment à partir de ces informations qu'ont été établis les tableaux A6-1 et A6-2 qui détaillent le volume et la valeur des captures.

[1] Jaugeon et Juncker (2021) fournissent des informations sur le concept de « pêcheur professionnel » à Wallis et Futuna. Une réglementation adoptée en 2005 a conféré un statut juridique au pêcheur professionnel. La détention d'une licence de pêcheur professionnel n'est pas une autorisation de pêcher, mais permet au pêcheur de vendre ses prises et de bénéficier d'aides publiques pour l'achat de carburant ou d'engins de pêche et d'une offre de formations, tout en lui faisant également obligation d'immatriculer son bateau, de communiquer ses fiches de pêche et d'utiliser du matériel de sécurité.

**Tableau A6-1 :** Volume des captures par année et par groupe d'espèces (exprimé en tonnes)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Poissons marins divers | 170 | 206 | 240 | 262 | 231 | 231 |
| Thons | 9 | 7 | 17 | 27 | 12 | 12 |
| Crabes de cocotier | 0 | 0 | 0 | 0 | 7 | 7 |
| Autres invertébrés aquatiques | 0 | 0 | 0 | 0 | 7 | 7 |
| Crabes de mer | 1 | 1 | 1 | 1 | 2 | 2 |
| Poulpes, calmars | 1 | 1 | 1 | 1 | 2 | 2 |
| Poissons d'eau douce | 0 | 0 | 0 | 0 | 1 | 1 |
| Langoustes | 1 | 1 | 1 | 1 | 1 | 1 |
| Huîtres du Pacifique | 0 | 0 | 0 | 0 | 1 | 1 |
| Holothuries | 0 | 0 | 0 | 0 | 0 | 0 |
| Bénitiers | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **182** | **216** | **260** | **292** | **264** | **264** |

Source : adapté d'un tableau établi par le Service de la pêche et de la gestion des ressources marines à l'intention de la FAO.

**Tableau A6-2 :** Valeurs des captures en 2021

| | Volume des captures en 2021 (tonnes) | Valeur des captures en (francs CFP/kg) | Valeur des captures par groupe d'espèces (francs CFP) |
|---|---|---|---|
| Poissons marins divers | 231 | 816 | 188 496 000 |
| Thons | 12 | 1 138 | 13 656 000 |
| Crabes de cocotier | 7 | 1 473 | 10 311 000 |
| Autres invertébrés aquatiques | 7 | 635 | 4 445 000 |
| Crabes de mer | 2 | 1 367 | 2 734 000 |
| Poulpes, calmars | 2 | 1 424 | 2 848 000 |
| Poissons d'eau douce | 1 | 200 | 200 000 |
| Langoustes | 1 | 2 113 | 2 113 000 |
| Huîtres du Pacifique | 1 | 1 500 | 1 500 000 |
| **Total** | **264** | ---- | **226 303 000** |

Source : adapté d'un tableau établi par le Service de la pêche et de la gestion des ressources marines à l'intention de la FAO.

Les tableaux ci-dessus présentent le volume et la valeur de la totalité de la production halieutique de Wallis et Futuna qui, hormis une tonne de poissons d'eau douce, correspond à celle de la pêche côtière. Aux fins de la présente étude, on fera la distinction entre la pêche côtière professionnelle et la pêche côtière vivrière. Pour ce faire il convient de tenir compte de la destination des captures, qui diffère entre Wallis et Futuna et permet de déterminer si elles relèvent de la pêche professionnelle ou vivrière. Le Rapport annuel 2021 de l'Observatoire des pêches côtières (Anon. 2022a) cite une étude qui définit trois catégories à cet égard (tableau A6-3), les catégories #1 et #2 correspondant à la pêche vivrière au sens de la présente étude.

**Tableau A6-3 :** Destination des captures à Wallis et à Futuna

| | Wallis | Futuna |
|---|---|---|
| 1. Don | 28 % | 41 % |
| 2. Autoconsommation | 50 % | 53 % |
| 3. Vente | 22 % | 6 % |

On peut également lire dans ce rapport annuel qu'en 2021, la production des pêcheurs professionnels s'élevait à 23,6 tonnes à Wallis et à 11,3 tonnes à Futuna (soit un total de 35,1 tonnes correspondant à 13 % de la production halieutique totale de 264 tonnes). Il est toutefois probable que des pêcheurs non professionnels vendent également leurs captures.

Aux fins de la présente étude, on partira de l'hypothèse de la vente de 16 % environ de la totalité de la production halieutique côtière (soit 42 tonnes). Sur la base des chiffres figurant dans le tableau A6-2 ci-dessus et en utilisant la même méthode (prix à la production) que pour la pêche vivrière, on peut estimer la valeur de la production de la pêche côtière professionnelle à Wallis et Futuna à quelque 48 millions de francs CFP départ pêcheur (soit 42 tonnes à 1 147 francs CFP/kg).

### Captures de la pêche côtière vivrière

En suivant le même raisonnement, on peut estimer à 221 tonnes les captures de la pêche côtière vivrière pour 2021 à Wallis et Futuna. Sur la base du prix à la production, la valeur de ces captures est évaluée à 177,4 millions de francs CFP.

### Captures des unités de pêche hauturière locales

S'il est vrai que certains petits bateaux se livrent parfois à la pêche à la traîne à l'extérieur du récif pour cibler le thon et d'autres poissons pélagiques, ces activités sont considérées comme relevant de la pêche côtière aux fins de la présente étude. Il n'existe pas actuellement de flottille locale de pêche hauturière à Wallis et Futuna.

Le dernier palangrier local recensé a été en activité pendant environ deux ans à partir de 2010 (B. Mugneret, communication personnelle, janvier 2023).

### Captures des unités de pêche hauturière battant pavillon étranger

Aucun navire étranger n'est actuellement autorisé à pêcher dans les eaux territoriales de Wallis et Futuna. Il faut remonter à 1999 pour recenser ce type de pêche (Service de la pêche et de l'aquaculture 2007). Des discussions avec des exploitants américains de senneurs entamées en 2014 ont rapidement tourné court (Mugneret et Jaugeon, 2019).

### Captures en eau douce

On ne trouve que très peu de poissons d'eau douce à Wallis et Futuna. Le tilapia a certes été introduit dans certains plans d'eau à Wallis (Hinds 1969), mais il n'est pas considéré comme un poisson de bouche. On capture quelques crevettes d'eau douce dans les ruisseaux de Futuna.

Dans le tableau A6-2 ci-dessus, la production de la pêche dulcicole est estimée à une tonne, pour une valeur de 200 000 francs CFP.

### Production aquacole

Si des expérimentations ont été réalisées par le passé dans le domaine de l'aquaculture à Wallis (*Macrobrachium* par exemple, Nandlal 2005), on ne recense pas actuellement de production aquacole sur le Territoire (B. Mugneret, communication personnelle, janvier 2023).

### Synthèse des captures

Le tableau A6-4 présente une première approximation du volume et de la valeur de la production de la pêche et de l'aquaculture à Wallis et Futuna pour l'année 2021.

**Tableau A6-4** : Production annuelle de la pêche et de l'aquaculture à Wallis et Futuna, 2021

| Secteur de production | Volume (tonnes) | Valeur (francs CFP) |
|---|---|---|
| Pêche côtière professionnelle | 42 | 48 000 000 |
| Pêche côtière vivrière | 221 | 177 400 000 |
| Pêche hauturière locale | 0 | 0 |
| Pêche hauturière étrangère | 0 | 0 |
| Pêche en eau douce | 1 | 200 000 |
| Aquaculture | 0 | 0 |
| **Total** | **264** | **225 600 000** |

Les figures A6-1 et A6-2 illustrent le volume et la valeur de la production halieutique à Wallis et Futuna en 2021.

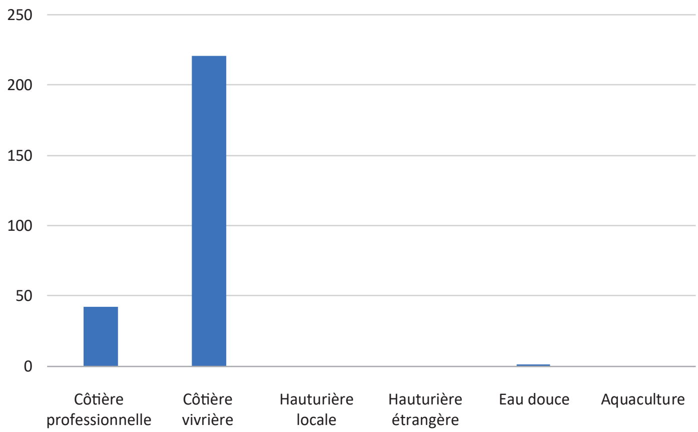



**Figure A6-1 :** Volume de la production halieutique de Wallis et Futuna en 2021 (exprimé en tonnes)

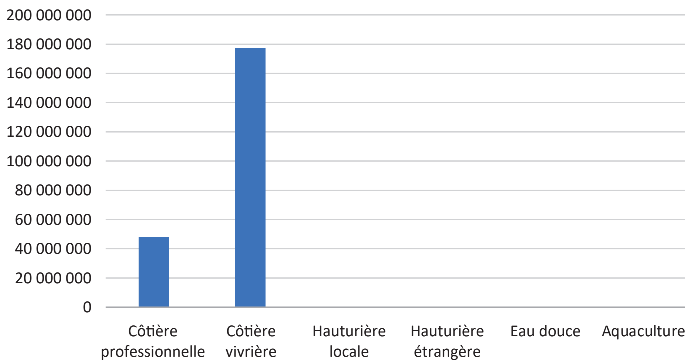



**Figure A6-2 :** Valeur de la production halieutique de Wallis et Futuna en 2021 (exprimée en francs CFP)

## Estimation de la production halieutique dans les précédentes études Benefish

Un certain nombre d'études portant sur les retombées de la pêche dans les pays océaniens (Études Benefish) ont déjà été réalisées. Gillett et Lightfoot (2001) se sont intéressés à l'année 1999, Gillett (2009a) à 2007, Gillett (2016) à 2014, tandis que la présente étude porte sur l'année 2021. Les niveaux de la production halieutique de Wallis et Futuna mis en évidence par ces trois études sont reproduits au tableau A6-5.

**Tableau A6-5 :** Estimations de la production annuelle de la pêche et de l'aquaculture issues des études Benefish

| Secteur de production | Année | Volume (tonnes) | Valeur nominale (francs CFP) |
|---|---|---|---|
| Pêche côtière professionnelle | 1999 | n/d | n/d |
| | 2007 | 121 | 105 000 000 |
| | 2014 | 150 | 150 000 000 |
| | 2021 | 42 | 48 000 000 |
| Pêche côtière vivrière | 1999 | n/d | n/d |
| | 2007 | 840 | 551 000 000 |
| | 2014 | 675 | 641 250 000 |
| | 2021 | 221 | 177 400 000 |
| Pêche hauturière locale | 1999 | n/d | n/d |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Pêche hauturière étrangère | 1999 | n/d | n/d |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |
| Pêche en eau douce | 1999 | n/d | n/d |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 1 | 200 000 |
| Aquaculture | 1999 | n/d | n/d |
| | 2007 | 0 | 0 |
| | 2014 | 0 | 0 |
| | 2021 | 0 | 0 |

Source : présente étude, Gillett (2016), Gillett (2009a), Gillett et Lightfoot (2001)

# A6-2 Contribution de la pêche au PIB (Produit intérieur brut)

## Contribution officielle actuelle

Le rapport annuel sur l'économie de Wallis et Futuna en 2021 (IEOM 2022b) de l'Institut d'émission d'outre-mer évoque le PIB du Territoire en indiquant qu'il n'existe pas à Wallis et Futuna de structure publique chargée du calcul de cet indicateur. En 2008, un organisme parisien, Comptes économiques rapides pour l'Outre-Mer, s'est employé à évaluer le PIB de Wallis et Futuna, le chiffrant à 18 milliards de francs CFP pour l'année 2005. Le rapport de l'IEOM indique qu'aucune autre estimation du PIB n'a été réalisée depuis.

### Méthode de calcul de la contribution officielle de la pêche au PIB

On ne dispose d'aucune information sur le mode de calcul du PIB de Wallis et Futuna. Lors d'entretiens réalisés en 2015 avec des agents du Service territorial de la statistique, ces derniers ont dit ne pas avoir connaissance de la méthode employée pour estimer le PIB et ignorer si la pêche était prise en compte.

### Estimation de la contribution de la pêche au PIB

Le tableau A6-6 ci-dessous présente une méthode d'estimation de la contribution de la pêche au PIB de Wallis et Futuna. Il s'agit d'une approche simplifiée de la production consistant à prendre en compte les cinq types d'activités de pêche/aquaculture, dont la valeur de production a été établie plus haut (et récapitulée au tableau A6-4), et à déterminer la valeur ajoutée à l'aide de coefficients correspondant à chacun des types de pêche concernés, établis sur la base de la connaissance du secteur halieutique et d'études spécialisées (Appendix 3).

**Tableau A6-6 :** Contribution de la pêche au PIB de Wallis et Futuna en 2021

| Secteur de production | Valeur brute de la production (en francs CFP, reprise du tableau ##) | Coefficient de valeur ajoutée | Valeur ajoutée (francs CFP) |
|---|---|---|---|
| Pêche côtière professionnelle | 48 000 000 | 0,65 | 31 200 000 |
| Pêche côtière vivrière | 177 400 000 | 0,80 | 141 920 000 |
| Pêche hauturière locale | 0 | 0 | 0 |
| Pêche en eau douce | 200 000 | 0,90 | 180 000 |
| Aquaculture | 0 | 0 | 0 |
| **Total (francs CFP)** | **225 600 000** | --- | **173 300 000** |

Il n'est pas possible de déterminer à quelle proportion du PIB de Wallis et Futuna cette somme de 173,3 millions de francs CFP correspond : le tableau ci-dessus se rapporte en effet à l'année 2021, alors que le dernier calcul du PIB concerne l'année 2005. Dans son étude, Gillett (2009a) indique que la contribution de la pêche au PIB en 2007, estimée à 50 millions de francs CFP, représentait 2,8 % du PIB du Territoire pour l'année 2005.

## A6-3 Exportations des produits de la mer

On n'a enregistré aucune exportation significative de produits de la mer à partir de Wallis et Futuna en 2021.

Il est arrivé par le passé que le Territoire exporte des trocas et des holothuries. D'après les agents de la DSA, la dernière expédition de trocas a eu lieu juste avant la pandémie et représentait moins d'un conteneur. Les dernières exportations d'holothuries datent quant à elles de 2011 ou 2012 et sont interdites depuis 2015 à l'initiative du Service de l'environnement du Territoire (B. Mugneret, communication personnelle, janvier 2023).

## A6-4 Recettes publiques tirées de la pêche

### Droits d'accès acquittés par les flottilles de pêche étrangères

Depuis 1999, aucun accord d'accès n'a plus été accordé à des flottilles de pêche étrangères (Service de la pêche et de l'aquaculture, 2007). De ce fait, aucune redevance n'est plus perçue à ce titre. La flottille locale n'est assujettie à aucun droit d'accès.

### Autres recettes publiques issues de la pêche

Le secteur de la pêche de Wallis et Futuna n'est pas producteur de recettes, mais plutôt consommateur de subventions publiques. D'après Anon. (2022b), deux grandes catégories d'aides sont prévues pour le secteur de la pêche :

- Aides à l'investissement. Il s'agit de subventions pour l'achat de bateaux, de matériel de pêche, d'équipements et de matériel de transformation. En 2021, le montant des aides versées à ce titre s'est chiffré à 9,5 millions de francs CFP à Wallis et à 4,3 millions à Futuna.
- Aide au carburant. Cette aide peut aller jusqu'à 60 % du carburant consommé lors des sorties de pêche. En 2021, 2,6 millions de francs CFP ont été versés aux pêcheurs de Wallis et 1,5 million à ceux de Futuna, pour un total de 23 bénéficiaires.

## A6-5 Emplois associés au secteur de la pêche

Le rapport de l'Observatoire des pêches côtières de Wallis et Futuna (Anon. 2022a) fournit les informations suivantes au sujet des emplois associés au secteur de la pêche :

- En 2021, on recensait 28 pêcheurs professionnels à Wallis et 8 à Futuna.
- Deux femmes pratiquaient la pêche professionnelle, une à Wallis et l'autre à Futuna
- L'âge moyen des pêcheurs professionnels était de 49 ans, le plus jeune étant âgé de 16 ans et le plus âgé de 65 ans.

Comme on l'a indiqué plus haut, plusieurs éléments pointent une diminution de l'importance de la pêche à Wallis et Futuna au cours des dernières décennies. Dans son rapport annuel sur l'économie de Wallis et Futuna en 2021 (IEOM 2022b), l'Institut d'émission d'outre-mer cite l'enquête sur le budget des familles réalisé en 2019-2021 dont il ressort que, si en 2006, 35 % des ménages du Territoire pratiquaient la pêche vivrière, ils n'étaient plus que 9 % à le faire en 2019-2020. D'après les agents de la DSA, alors que l'on comptait environ 2 000 pêcheurs (pratiquant la pêche professionnelle et vivrière) en 2014, en 2021 ce chiffre était plus proche de 200.

## A6-6 Niveaux de consommation de la ressource halieutique

La consommation de poisson à Wallis et Futuna a fait par le passé l'objet d'un certain nombre d'études dont on peut retenir les éléments suivants :

- Sur la base de la production halieutique de Wallis et Futuna ainsi que des chiffres des importations et des exportations de produits de la mer, Gillett et Preston (1997) ont estimé qu'au début des années 90, le volume de poisson disponible par habitant s'élevait à 66,9 kg par an.
- Bell et al. (2009b) ont exploité les données issues des enquêtes sur les revenus et les dépenses des ménages réalisées entre 2001 et 2006 pour procéder à une estimation des modes de consommation du poisson dans les pays océaniens. Ces enquêtes avaient été conçues pour déterminer la part de la consommation attribuable respectivement aux produits de la pêche vivrière et aux achats en espèces. Les données de l'enquête réalisée à Wallis et Futuna entre juin 2005 et mai 2006 (Buffière 2006) ont permis d'établir la consommation annuelle de poisson par habitant (en poids entier équivalent) à 74,6 kg, dont 98 % de poisson frais.
- Gillett (2016) estime la production de la pêche côtière (vivrière et professionnelle) pour l'année 2014 à 825 tonnes, ce qui correspond à 68,7 kg pour chacun des 12 011 habitants de Wallis et Futuna. Ce chiffre ne tient pas compte des importations de produits halieutiques.
- IEOM (2022b) révèle qu'en moyenne, un habitant de Wallis et Futuna consommait entre 23 et 27 kg de poisson par an en 2020, contre 75 kg en 2006.

Le rapport de l'enquête sur le budget des familles à Wallis et Futuna pour 2020 (SPC et STSEE 2022) détaille la fréquence de consommation des principaux produits halieutiques (tableau A6-7). Il ressort également de cette publication qu'en 2006, 17 % des ménages déclaraient consommer du poisson frais, mais qu'ils n'étaient plus que 5 % dans cette catégorie 14 ans plus tard.

**Tableau A6-7 :** Fréquence de la consommation des produits de la pêche en 2020

| Produit | Provenance du produit | Pourcentage des ménages ayant déclaré avoir consommé le produit au cours des 14 derniers jours |
|---|---|---|
| Autre poisson | Local | 22 % |
| Poisson du lagon | Local | 20 % |
| Crevettes | Importé | 3 % |
| Crabes de cocotier | Local | 2 % |
| Moules | Importé | 2 % |
| Poisson en boîte | Importé | 1 % |
| Thon (frais, surgelé) | Local | 1 % |
| Préparations à base de poisson | Importé | 1 % |
| Trocas | Local | 1 % |
| Langoustes | Local | 1 % |
| Crabes de mer | Local | 0 % |
| Moules cuites | Importé | 0 % |

Source : SPC et STSEE (2022)

On consomme davantage de produits de la mer à Futuna (34,6 kg/habitant/an) qu'à Wallis (19,4 kg/habitant/an), ce qui correspond à une consommation annuelle moyenne de 27 kg par habitant du Territoire, soit une baisse considérable par rapport à la moyenne de 75 kg par habitant enregistrée en 2006 (DSA 2022).

## A6-7 Taux de change

Les taux de change annuels moyens (franc CFP en dollar É.-U.) utilisés dans le présent ouvrage sont les suivants :

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 89,88 | 86,01 | 98,13 | 108,81 | 114,17 | 99,42 | 104,39 | 106,78 | 98,00 | 105,37 | 120,27 |

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## Fisheries in the Economies of Pacific Island Countries and Territories

This book gives the results of a study of the benefits to Pacific Island countries and territories from the fisheries in the region. This is the fourth study in the "Benefish" series, with previous studies published in 2001, 2008, and 2016 in partnership with the Asian Development Bank, the Forum Fisheries Agency, and the World Bank.

In this edition, the fisheries of the region are divided into six categories: coastal commercial; coastal subsistence; offshore locally based; offshore foreign-based; freshwater; and aquaculture. For each of these fishery types, the best available information is used to estimate annual production in recent years in each of the 22 countries and territories in terms of both value and volume. In addition, national estimates are made of the various types of benefits from the fisheries in five categories: the contributions to GDP, exports, government revenue, employment and food supplies.

The results from the above work enable comparisons between and across countries and over time. This assessment shows the relative importance of the six types of fisheries and how this importance has evolved over time—on both national and regional levels. It also identifies where data on the fisheries are insufficient and where additional efforts need to be made to prevent the dissipation of benefits. In addition, this study explores the impacts of the COVID-19 pandemic and climate change on fishery production and associated benefits.

Recommendations are made for countries, regional agencies, international institutions and donors. These suggestions cover improvements to the measurement of fishery production and fishery benefits; undertaking future Benefish studies; and the importance of data in the fisheries management process.

## The Pacific Community

The Pacific Community (SPC) is the principal scientific and technical organisation supporting development in the Pacific region. It is an international organisation owned and governed by its 27 members, including 22 Pacific Island countries and territories. For almost 77 years, the Pacific Community has been providing the Pacific Islands region with essential scientific and technical advice and services to achieve lasting improvement in people's lives.

The Pacific Community's headquarters are in Noumea, New Caledonia, and it has regional offices in Federated States of Micronesia, Fiji, Tonga and Vanuatu as well as a country office in Solomon Islands, and field staff in other countries and territories. It is one of nine member agencies of the Council of Regional Organisations of the Pacific (CROP). SPC's working languages are English and French.

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