FISHERIES IN THE ECONOMIES

of Pacific Island Countries and Territories

Robert Gillett

Pacific Community
Communauté du Pacifique

FFA

Australian Aid

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Contents

Foreword

Fisheries is a critical sector for food security and economic growth in the Pacific region. Maintaining up-to-date information about the impact of fisheries is critical for Pacific Island countries and territories (PICTs) and their communities to make informed decisions about management of the sector, and for a range of development organisations, institutions and donors to plan and implement effective development assistance in collaboration with PICTs.

However, finding accurate and up-to-date data on the value of fisheries and its numerous components to the economies of Pacific Island countries and territories is very difficult, and this makes the assessment of development and change very difficult to measure over time. To address this information deficit in the past, the Asian Development Bank (ADB), with the World Bank, the Australian Government, the Pacific Community (SPC) and the Pacific Islands Forum Fisheries Agency (FFA) undertook to embark on a series of studies of fisheries in the Pacific region: the 2001 report, The Contribution of Fisheries to the Economies of Pacific Island countries, and the 2009 report, Fisheries in the Economies of the Pacific Island Countries and Territories. These reports provided a snapshot on where each PICT was in their fisheries development, including an assessment of the contribution of fisheries to gross domestic product (GDP). The 2009 report stated: "The study was also intended to provide the basis for progressive refinement and development of a regular assessment of the region's fisheries, which ideally would be done every 4–5 years."

In early 2015, in response to a growing demand for up-to-date data on the contribution of fisheries to economies in the Pacific region, SPC's Fisheries, Aquaculture and Marine Ecosystems (FAME) Division, with support from the FFA, approached the Australian Department of Foreign Affairs and Trade (DFAT) for funding to undertake a complete update of the 2009 study. This would allow a new baseline to be set in assessing the value of fisheries to PICTs, both for measuring achievements and for assessing future improvements. It would also document changes in the management of the Pacific tuna fishery, food security concerns for coastal fisheries in the face of growing populations, and the effects these have on the economies of PICTs. DFAT, through Australian Aid, kindly agreed to fund the study. SPC contracted the consultant who wrote the 2001 and 2009 studies, Mr Robert Gillett, to undertake the work using the same processes, procedures and techniques that were used in the 2009 report, to ensure comparability of data between the editions.

It was agreed the PICT chapters of the study should cover the following:

- Volumes and value of fish harvested
- Contribution of fisheries to GDP
- Exports of fishery production
- Government revenue from fisheries
- Fisheries-related employment
- Levels of fishery resource consumption
- Exchange rates.

The same topic areas were to be covered in comparative chapters to provide a regional perspective of the value of fisheries to PICTs. These analyses would be based on 2014 data, to allow comparison with the 2009 study, which was based on 2007 data.

The consultant commenced work in August 2015, with several months of fieldwork collecting data, primarily from Fisheries Departments and National Statistics Offices, and from other in-country sources. The consultant visited 18 PICTs, and used local consultants in several locations. The final report – Fisheries in the Economies of Pacific Island Countries and Territories 2016 (second edition) – was edited and produced by SPC, and was published in June 2016.

This new report provides a range of critical, original information in a range of fisheries fields that will be extremely useful for PICTs, regional organisations, research institutions, non-governmental organisations and donors.

In undertaking this work the consultant highlighted the difficulties in finding recent data on fisheries from within fisheries departments, as some PICTs are not producing annual reports or other published fisheries data. I would strongly urge PICTs to collect and publish fisheries data annually, to enable the region to maintain an accurate picture of the impact of fisheries for PICTs and the region.

The information in this report will remain relevant for several years. However, the study should be undertaken again in another four to five years to maintain the currency of fisheries data, which will ultimately help to maintain the sustainability of a sector that is fundamental in the lives of Pacific people.

Dr Colin Tukuitonga
Director-General
Pacific Community

About the Author

Robert Gillett, a director of Gillett, Preston and Associates (gillett@connect.com.fj) has been involved in marine resources development in the Pacific region and beyond for four-and-a-half decades. He has undertaken work for several regional and international organisations active in the marine sector in the region, including the United Nations Development Programme, the Pacific Community, Forum Fisheries Agency, Food and Agriculture Organization of the United Nations, World Bank, Secretariat of the Pacific Regional Environment Programme, University of the South Pacific, Pacific Islands Forum Secretariat, Commonwealth Secretariat, and Asian Development Bank. Mr Gillett has authored more than 250 publications, books and technical reports on fisheries in the region.

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Many people contributed to this study (referred to as the Benefish study). Three individuals were particularly helpful. Lindsay Chapman of SPC performed a critical role in generating interest in this updated version of the previous Benefish study, liaising with the donor, making administrative arrangements for the work, providing the study consultant with logistics support, and responding to requests for information. Perry Head, formerly of the Australian Department of Foreign Affairs and Trade, was responsible for organising funding for the work and facilitating the SPC contracting. Gerald Haberkorn, of SPC's Statistics for Development Division, has been a long-time supporter of the Benefish studies. He provided a large amount of assistance dealing with liaison with the statistical agencies of the region, technical issues and encouragement.

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Several individuals assisted in reviewing chapters of this book. These include Francis Hickey, Jeff Kinch, Aymeric Desurmont, Richard Banks, Steve Lindley, Stacy Jupiter, Tricia Emberson, Teri Luciani, Javier Cuetos-Bueno, Noah Idechong, Mike Savins, Garry Preston, Ursula Kaly, Mike McCoy, Kelvin Passfield, Kevin Rhodes, Maurice Brownjohn, Ian Bertram, Jackie Fa'anunu, and Mike Batty. Ian Cartrwright is acknowledged for his general review of this book.

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Abbreviations

ACP	African, Caribbean and Pacific
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)
BPNG	Bank of Papua New Guinea
CBSI	Central Bank of Solomon Islands
CIF	cost insurance freight
CIPA	Cook Islands Pearl Authority
CITES	Convention on the International Trade of Endangered Species
CMI	College of the Marshall Islands
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
CPP	Central Pacific Producers (of Kiribati)
DAM	Direction des Affaires Maritimes (of New Caledonia)
DMWR	Department of Marine and Wildlife Resources (of American Samoa)
DevFish	Development of Tuna Fisheries in the Pacific ACP Countries
DFAT	Department of Foreign Affairs and Trade (of Australia)
DFMR	Department of Fisheries and Marine Resources
DRMM	Direction des Ressources Marines et Minières (of French Polynesia)
DWFN	distant water fishing nation
EEZ	exclusive economic zone
ENSO	El Niño Southern Oscillation
EPPSO	Economic Planning Policy and Statistics Office (of Marshall Islands)
ESCAP	Economic and Social Commission for Asia and the Pacific
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
FFA	Forum Fisheries Agency

FOB	free on board
FRP	fibre-reinforced plastic
FSM	Federated States of Micronesia
FTE	full-time equivalents
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	Harmonised System of Tariff Classification
IAS	Institute of Applied Science of the University of the South Pacific
IC	intermediate consumption
IMF	International Monetary Fund
ISIC	International Standard Industrial Classification of All Industrial Activities
ISPF	Institut de la Statistique de la Polynesie Francaise
ISEE	Instut de la Statistique et des Etudes Economique (of New Caledonia)
IUCN	International Union for Conservation of Nature
IUU	Illegal, unreported and unregulated (fishing)
JICA	Japan International Cooperation Agency
Kg	kilogram
km	kilometre
km^2	square kilometres
Lb	pound
MACBIO	Marine and Coastal Biodiversity Management in Pacific Island Countries
MFA	Micronesian Fisheries Authority (formerly MMA)
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 Cook Islands)
MPA	marine protected area
mt	metric ton
NAFICOT	National Fishing Corporation of Tuvalu
NEPO	National Economic Planning Office
NFA	National Fisheries Authority (of PNG)

NFC	National Fisheries College (of PNG)
NFMRA	Nauru Fisheries and Marine Resources Authority
NGO	non-governmental organisation
NMFS	National Marine Fisheries Service (of the United States)
NORMA	National Oceanic Resource Management Authority (of FSM)
NSO	National Statistics Office (of PNG)
OFCF	Overseas Fisheries Cooperation Foundation (of Japan)
OFD	Offshore Fisheries Division (of the Cook Islands Ministry of Marine Resources)
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)
PRISM	Pacific Regional Information SysteM (SPC)
RMI	Republic of Marshall Islands
SAM	Social Accounting Matrix (of Federated States of Micronesia)
SNA	System of National Accounts
SPC	Pacific Community (formerly Secretariat of the Pacific Community, South Pacific Commission)
TDS	Tonga Statistics Department
TML	Te Mautari Limited
UN	United Nations
UNDP	United Nations Development Programme
US	United States
VA	value added
VAR	value added ratio
VAT	value added tax
VDS	Vessel Day Scheme
VMS	vessel monitoring system
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	western and central Pacific Ocean
WPacFIN	Western Pacific Fisheries Information Network

Currency Equivalents

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

	Australia	New Zealand	Papua New Guinea	Solomon Islands	French Territories	Vanuatu	Fiji Islands	Tonga	Samoa
2000	1.74	2.19	2,76	5.09	130.00	137.80	2.13	1.64	3.27
2001	1.95	2.38	3,36	5.28	133.00	145.70	2.33	1.95	3.47
2002	1.83	2.15	3.89	6.75	127.00	139.10	2.15	2.18	3.37
2003	1.52	1.72	3.55	7.51	106.00	122.20	1.85	2.19	3.00
2004	1.36	1.51	3.22	7.48	96.00	111.90	1.73	2.04	2.78
2005	1.31	1.42	3.10	7.53	96.00	109.00	1.70	1.93	2.71
2006	1.32	1.54	3.06	7.61	95.00	110.00	1.73	2.01	2.78
2007	1.19	1.36	2.96	7.65	87.00	104.00	1.60	2.02	2.62
2008	1.10	1.32	2.77	7.67	80.00	96.77	1.51	1.85	2.52
2009	1.12	1.39	2.65	7.88	83.22	99.72	1.92	1.90	2.50
2010	1.10	1.30	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

Unless other specified, in this report "$" refers to US dollars.

1 Executive Summary

The study

In 2001 and 2008 the Asian Development Bank undertook studies to quantify benefits from the fisheries sectors of Pacific Island countries. Summaries of those studies are provided in Appendix 1 of the present book.

In February 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 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 of this book

This 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 gross domestic product is provided, along with guidelines on estimating the contribution to GDP of fishing.

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:

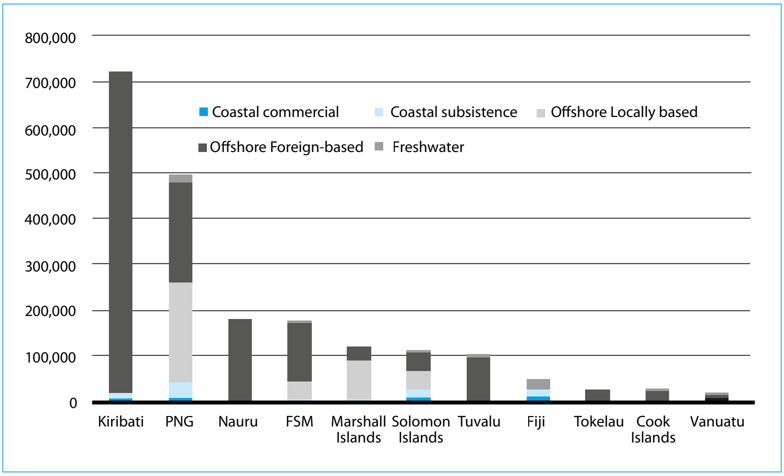
- Recent annual fishery harvests: values and volumes covering the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.
- Fishing contribution 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 and 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

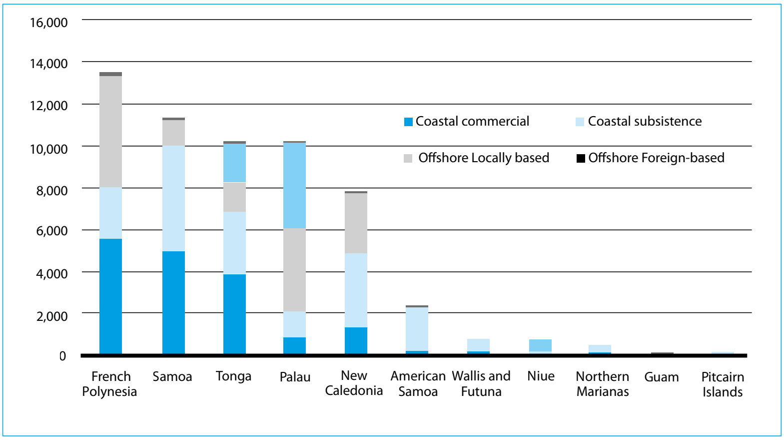
It is estimated the volume of all fisheries and aquaculture production in the region in the six fisheries categories in 2014 was about 2.0 million metric tonnes (mt), worth US$3.2 billion.

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. The present 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.

Volume of fishery production in 2014 in the higher-producing countries (mt)



Volume of fishery production in 2014 in the lower-producing countries (mt)



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 Papua New Guinea (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 is readily apparent, and has 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 all 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 (one of the parties 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 mt 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 mt (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 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 household income and expenditure surveys (HIES) to improve the situation, the applicability of HIES to coastal fisheries deserves more attention.

Household income and expenditure survey (HIES)

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 Federated States of Micronesia chapter of this book indicates promising results for using the new "fisheries-friendly" HIES. This should serve to encourage fisheries departments in the region to make more use of HIES in their coastal fisheries work.

Contribution of fishing to GDP

In the country and territory chapters of this book the official gross domestic product (GDP) and the 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: value added ratios, the GDP status of locally based foreign fleets, and formulating satellite accounts for fisheries in each country

Exports of fishery products

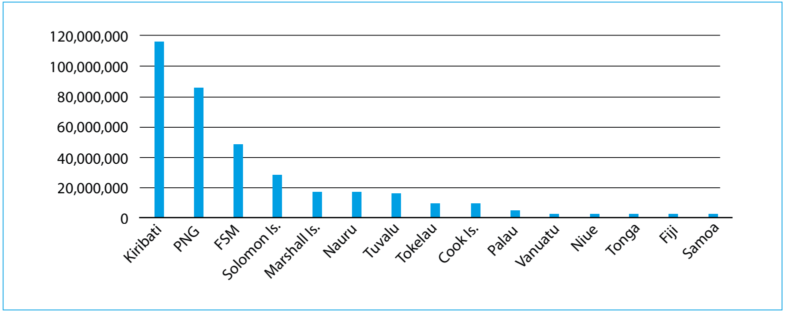
The annual value of fishery exports in 2014 is given for each country, in absolute terms and relative to all exports. The findings show that, while fishery exports represent less than 40% of the value of all national exports, in some countries they are quite large in nominal terms, for example: PNG

(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 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.

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 receive 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 the Forum Fisheries Association'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 inter-country 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

The 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 Federated States of Micronesia (FSM), have the highest fish consumption rates. The low fish consumption levels in Marshall Islands appears to be counter-intuitive, while the 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 the present 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 over-exploited. Because the population of the region is increasing, the per capita production of fish from coastal fisheries is decreasing, 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 the 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

23 technical recommendations are made about how to improve the 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 the present study is that mechanisms should be explored for encouraging this inter-agency 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 alternatively 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 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.

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 attention on effective coastal fisheries management. Because coastal fisheries provides 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 vessel), 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 1: Some Surprising Facts to Emerge from the Study

- The 2014 tuna catch in Kiribati was 40.7% of the regional total, and was valued at about US$1 billion.
- 52.7% of all employment in the region that is directly related to the tuna industry is in Papua New Guinea.
- The volume of production from the coastal commercial fisheries of Samoa in 2014 was almost equivalent to PNG's levels. The volume of production from the coastal commercial fisheries of Fiji is almost twice as high as that of PNG, despite PNG's population being almost 9 times greater than Fiji's.
- 93% of the value of all aquaculture in the region is produced in two French territories: French Polynesia and New Caledonia.
- In only six PICTs in the region is aquaculture a significant commercial activity (i.e. where the production value is greater than 5% of that of coastal fisheries) – all but one of those PICTs (Cook Islands) are territories.
- American Samoa's fishery exports represent almost half (47%) of the fishery exports of all other countries and territories combined. The value of PNG's fishery exports represents about 41% of the value of fishery exports from all other independent countries combined.
- The total value of fishery exports from the region fell by about 42% (in real terms) in the period 2007–2014. The fall in the value of canned tuna exports from American Samoa was responsible for about 37% of the total regional decline.
- In the period 2007–2014 (coinciding with the period when the PNA Vessel Day Scheme was introduced and became fully operational) access fees for foreign fishing increased almost three-fold (279%).
- In 2014 four countries in the region received access fees that represented more than US$1,000 per capita.

2 Background

In early 2001 Asian Development Bank (ADB) expressed concern that the importance of fisheries to Pacific Island economies was not being fully appreciated by the countries of the region or by the donor community. Discussions with the Forum Fisheries Agency (FFA), the Pacific Community (SPC), and the World Bank led to a study (the Benefish study) to improve the accuracy of the estimates of the contribution of fisheries to national economies. The output of that study was the book "The Contribution of Fisheries to the Economies of Pacific Island Countries" (Gillett and Lightfoot 2001). Areas of emphasis in that volume include the following:

- Identifying the official contribution of fishing to GDP, articulating a simple approach for estimating fishing contribution to GDP and making estimates of fishing contribution to GDP for each Pacific Island country (the first Benefish study did not include aquaculture or freshwater fisheries in scope, and did not include the non-independent territories).
- Illustrating the major reasons for differences (official versus re-estimated) in the estimates of fishing contribution to GDP, and discussing the common difficulties found in estimating that contribution.
- Estimating volumes and values of the production from the four major components fishing in the region: coastal commercial, coastal subsistence, offshore locally based and offshore foreign-based.
- Providing summaries of the available data on the fisheries aspects of employment, trade, government revenue and nutrition.

In 2007 the Australian Agency for International Development (AusAID) produced a framework for engagement in fisheries-related development assistance in the Pacific region (AusAID 2007), which calls for the development of regularly updated and disaggregated information on the contribution of subsistence, small-scale commercial and industrial fisheries to the economies of Pacific island countries. In late 2007 AusAID initiated discussions with the Asian Development Bank on updating the 2001 Benefish study. In early 2008 these agencies agreed, in principle, on the value of, and need for, a revision and expansion of the original work. A formal funding agreement between AusAID and ADB was signed in July 2008. Discussions between AusAID, ADB, FFA, SPC and the World Bank (the project partners) resulted in an understanding that the new study should be similar to the 2001 project: that is, the assembling of existing information by country on production (volumes and values) and the fisheries' contributions to GDP, exports, government revenue, employment and nutrition. ADB recruited a consultant for the project, and work began on the study on 1 August 2008.

Visits to collect information were made to most Pacific Island countries and territories (the non-independent territories were included in this Benefish study), and headquarters of the regional organisations in the period August to October 2008. A meeting of all project partners was held in late September. Country-specific information was assembled, analysed and written up in November and December 2008, and the main text of the report was produced in January 2009. The book (Gillett 2009) was printed and distributed by ADB in May 2010. A summary of that book appears in Appendix 1 of the present report.

In early 2015 discussions between SPC and the Australian Department of Foreign Affairs and Trade (DFAT) resulted in an agreement to sponsor an update of the 2009 Benefish study. The same consultant was recruited, to ensure consistency with data collection and analysis. The fieldwork to collect information began on 1 August 2015, and was completed in early November. Country-specific information was assembled, analysed and written up from mid-November 2015 to late January 2016. The main text of the report, including the cross-country analysis, was produced in February 2016. Editing of the text at SPC commenced in January 2016.

One of the principles in writing this second edition of the Benefish study of fisheries in Pacific Island countries and territories was that the categories of data and methodology should remain consistent with the 2009 first edition – and with the previous edition from 2001 that did not include territories – to enable comparison between the three studies. The 2009 edition separated the countries and territories to enable easier comparison. This ordering format has been maintained in this second edition. Style and format conventions have been generally preserved between the first and second editions.

3 Study Considerations and Definitions

3.1 This Report

This report covers many of the same topics as the two earlier Benefish studies (Gillett and Lightfoot 2001; Gillett 2009). For the convenience of the target audience, this report does not need to be read in conjunction with the earlier studies – the important conclusions and recommendations from the earlier studies appear in Appendix 1, and many of the explanations and observations that are still valid are incorporated into the text of the present study.

The treatment of prices represents an important difference between the present study and Gillett and Lightfoot (2001). In this study, except where otherwise noted, fish prices given are the prices paid to the producer – either dockside prices, prices at first sale, or (for aquaculture and subsistence fishing) farm gate prices. For offshore fishing, a similar system is used, in which the readily available world market prices for the concerned fishery commodities are discounted by an amount to cover transport of the commodities to those markets – that is, a pricing system that closer reflects the in-zone value, which is an important consideration in periods of high fuel costs. Other aspects of prices in this report are as follows:

- In most cases the prices for production from offshore fishing are based on those given in a study by the Forum Fisheries Agency (FFA 2015), with adjustments for the volume and value of bycatch and for the cost of transport to destination markets.
- Where information judged to be more accurate than those in FFA (2015) is available (e.g. data from the American and French territories), the more reliable source is used.
- Unless otherwise stated, all gross domestic product (GDP) values are expressed in current market prices.

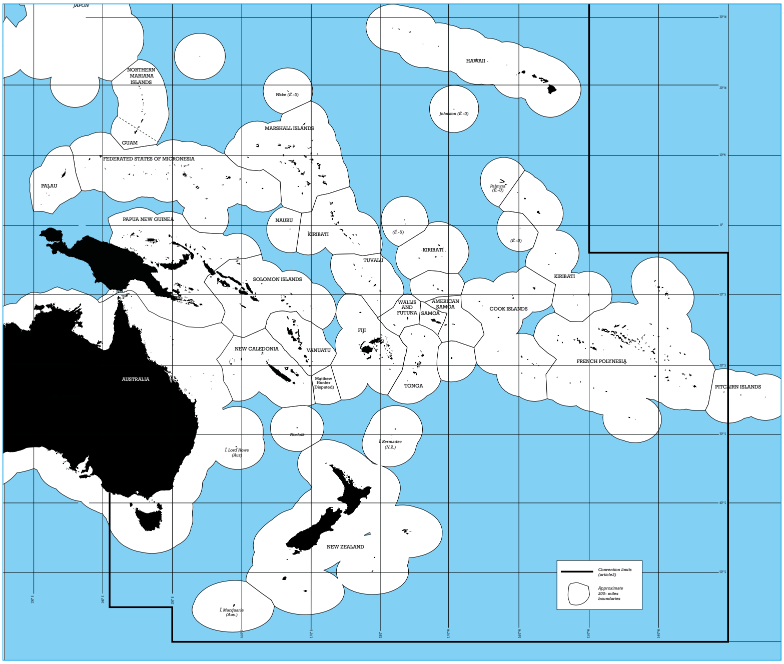
The valuing of subsistence fisheries production requires some special attention. There are several methods that could be used to assign a monetary value to subsistence production, including: (i) farm gate pricing (used in this report); (ii) the value of calories produced; (iii) the opportunity cost of labour; or (iv) 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 consultant has used the farm gate pricing method, as recommended by SPC in the 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

In fisheries of the Pacific Island region there is often uncertainty over the geographical area involved. The region could be considered to be 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 report consists of 22 Pacific Island countries and territories (PICTs)[1] and their associated 200-mile zones. This region can be seen within the wider Western and Central Pacific Fisheries Commission (WCPFC) area illustrated in Figure 3-1.

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

1 For convenience, "countries and territories" is often simplified to "countries" in this report, and unless otherwise specified, is taken to be inclusive.



Source: WCPFC

Figure 3-1: The Area Covered by the Western and Central Pacific Fisheries Commission

Table 3-1: Information on PICT 200-Mile Zones and Population Change

	Country/ Territory	Area of 200-mile Zone (km²)	2007 Population	2014 Population	% Change 2007– 2014
Independent Pacific Island Countries	Cook Islands	1,830,000	15,369	15,225	-0.9%
	FSM	2,978,000	104,754	102,908	-1.8%
	Fiji	1,290,000	836,239	863,073	3.1%
	Kiribati	3,550,000	95,470	111,117	14.1%
	Marshall Islands	2,131,000	53,059	54,550	2.7%
	Nauru	320,000	9,373	10,660	12.1%
	Niue	390,000	1,587	1,499	-5.9%
	Palau	629,000	20,162	17,862	-12.9%
	Papua New Guinea	3,120,000	6,324,106	7,570,686	16.5%
	Samoa	120,000	181,267	187,372	3.3%
	Solomon Islands	1,340,000	506,422	626,247	19.1%
	Tonga	700,000	102,248	103,347	1.1%
	Tuvalu	900,000	11,130	11,099	-0.3%
	Vanuatu	680,000	227,056	271,089	16.2%
Pacific Island Territories	American Samoa	390,000	63,563	56,803	-11.9%
	French Polynesia	5,030,000	259,300	262,059	1.1%
	Guam	218,000	172,390	179,523	4.0%
	New Caledonia	1,740,000	239,590	262,254	8.6%
	N. Mariana Islands	1,823,000	64,109	56,338	-13.8%
	Pitcairn Islands	800,000	49	49	
	Tokelau	290,000	1,169	1,166	-0.3%
	Wallis and Futuna	300,000	13,801	12,011	-14.9%
Total		30,569,000	390,000	10,776,937	15.8%

Source: SPC's PRISM website

3.3 Definitions

This study organises fish harvests in the Pacific Islands 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:** The catch that is sold (i.e. enters commerce) and that derives from fishing operations that take place in lagoon, reef, deep-slope or shallow sea areas. This category also includes fish caught by trolling/handing from small vessels in the open sea adjacent to islands.
- **Coastal subsistence:** The catch that is retained for consumption by the fisher or given away to family or friends. For simplicity, the catches from recreational fishing are considered as production for home consumption, and therefore as a component of subsistence fisheries.
- **Offshore locally based:** The catch from industrial-scale tuna fishing operations that: (a) are based at a port in the relevant Pacific Islands country; and (b) are generally harvested 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:** The catch from industrial-scale tuna fishing operations that are based at ports outside of the relevant country.
- **Aquaculture:** The 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:** The catch from streams, rivers and lakes, whether for subsistence or commercial purposes.

Some additional terminology clarifications are required, as follows:

- In this study "fishing" is considered to be the harvesting of aquatic animals and plants, and includes aquaculture unless otherwise stated.
- Similarly, "fisheries" is considered to be an inclusive term, and includes aquaculture and post-harvest activities.
- The terms "catch", "production" and "harvest" are considered to be equivalent.
- For GDP purposes, the economic sector is "fishing" rather than the more inclusive "fisheries" (Section 4-2 below). In this report, 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) to be 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 report. 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, has not resulted in locating the information. In several cases the term is used euphemistically for the situation in which a civil servant may have promised to send information but failed to do so.

4 National Accounts, GDP and Fishing

4.1 National Accounting

National accounts are an accounting framework used to measure the current economic activity in a country. Most of the countries in the Pacific region publish national accounts. The method used in each country is generally based on a standardised System of National Accounts (SNA) that was originally introduced by the United Nations in 1953. The SNA has since been revised and refined, and was republished most recently in 2009 (SNA 2008).[1]

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

- monitor changes in economic activity;
- make cross country comparisons;
- prepare time series analysis;
- identify functional relationships; and
- 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, as described in those chapters, the methods used within a country have changed between the various Benefish studies; hence, inter-temporal comparisons for those countries should also be approached with caution.

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.

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., economic activity that took place within a country during a specified period of time. GNI is the measure of national economic activity, which 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 from non-resident fishing by foreign operators. This income is classified as "rental income".

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

- The **production approach** views the economy from the perspective of production. The 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.

2 Prior to the 1993 revision of the System of National Accounts, Gross National Income was known as Gross National Product (GNP).

4.2 Important Considerations for the Fishing Sector

Gillett and Lightfoot (2001) discuss points in the SNA, which are especially important to the fishing sector, in considerable detail. Because that discussion is relevant to the present study it is provided as Appendix 2 in this book.

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

Fishing vs fisheries: The sector, according to SNA, is "fishing", rather than the more inclusive "fisheries". Post-harvest activities, including fish processing, are not included in the fishing sector, but rather are generally counted in manufacturing and other sectors. Both aquaculture and subsistence fishing are considered by 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 concept of the SNA. It defines what shall be counted as 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 SNA, locally based foreign fishing is part of the local economy, but where 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. Iceland's economy is highly dependent on fish and fishing. Fishery products made up 40% of exports in 2007. Despite this importance, the fishing sector contributed only 7% to GDP in 2007. (Ministry of Agriculture and Fisheries, 2008) 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.

Appendix 3 contains guidelines for calculating the fishing contribution to GDP. It gives some 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 report for 14 categories of fisheries and aquaculture.

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:

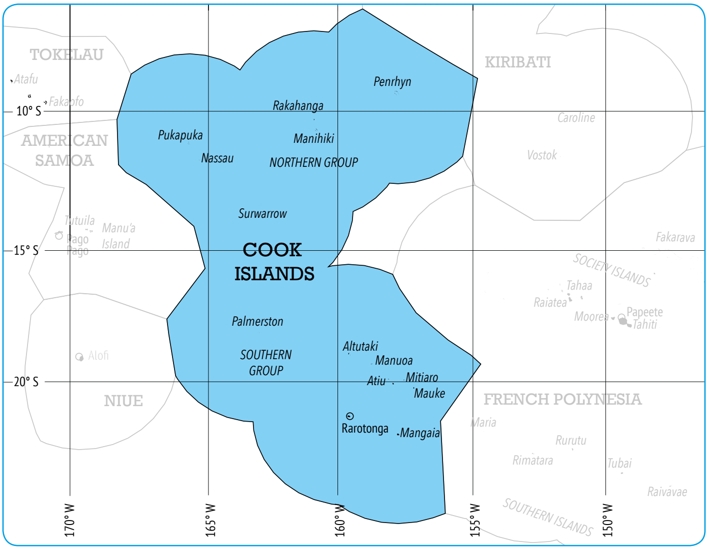
- The recent annual fishery harvests: values and volumes covering the six fishery production categories – (1) coastal commercial fishing; (2) coastal subsistence fishing; (3) locally based offshore fishing; (4) foreign-based offshore fishing; (5) freshwater fishing; and (6) aquaculture.
- Fishing contribution to GDP: the current fishing contribution, how it was calculated, and 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 Gillett (2009) study, but in some cases there has been not been any new data in the last decade. New data was 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, in all countries, to determine the volumes/values of recent annual fisheries harvests in the six production categories, considerable analysis and, in some cases, speculation (based on as much rigour as possible, including general understandings of the sector), was required.

Fishery Benefits in the Independent Pacific Island Countries

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 Cook Islands:

- Dalzell et al. (1996), using data sources from the late 1980s and early 1990s, estimated subsistence fisheries production of 858 mt, worth US$3,047,683, and commercial coastal fisheries production of 124 mt, 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 mt, NZ$650,000; aquarium fish NZ$252,000; and trochus NZ$200,000); and subsistence production, 795 mt.

- MMR (2001) estimated the value of the subsistence fisheries to be NZ$2 million annually.
- Gillett and Lightfoot (2001) considered the above studies and estimated production of 80 mt for coastal commercial fishing and pearl farming (worth NZ$19.5 million), and coastal subsistence production of 795 mt (worth NZ$2.2 million).

Gillett (2009) made catch estimates for all Pacific Island countries and territories, including Cook Islands. That study considered the previous estimates, described above, as well as additional information on coastal fisheries production in Cook Islands, from a study on the situation and outlook for Cook Islands Marine Resources 2007 (MMR 2008), and the Cook Islands household income and expenditure survey (HIES) that was carried out in 2005–06 (Statistics Office 2007).

The Situation and Outlook Report (MMR 2008) shows the following:

- The catch from the Cook Islands FAD fishery, by subsistence and semi-commercial fishers, in recent years, has oscillated between 20 and 50 mt of fish annually. In 2007 the catch was estimated at 49.3 mt. 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 mt catch was sold, and applying the farm gate pricing to subsistence catches, the production can be estimated as 16.41 mt for commercial (worth NZ$131,280) and 32.8 mt for subsistence (worth NZ$183,680). The Secretary of Marine Resources cautions that, although the information given here is the best available, the data (especially the FAD catches) may not be particularly accurate (I. Bertram, per. com. January 2009).
- 300 to 500 mt of commercial and subsistence catches are harvested annually from inshore fisheries (i.e. reef fish and shellfish). In 2007 the main semi-commercial inshore fisheries of trochus, parrotfish and live reef fish had mixed returns. There was no trochus harvest in 2007, 18 mt parrotfish were marketed in Rarotonga, at an average price of NZ$12 per kg, and 1500 to 1600 aquarium fish, worth NZ$54,000, were exported. Assuming that one-third of the inshore catch is sold, that the market price is NZ$9 per kg, and that farm gate pricing can be applied to subsistence production, commercial production would be about 133 mt (worth about NZ$1.4 million) and subsistence production would be about 267 mt (worth NZ$1.7 million).

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 SPC's Statistics and Demography Programme provides considerable information on coastal commercial and subsistence production. The HIES survey (with adjustment for offshore fishing, aquarium fish and any trochus harvested) suggests that, in the period 2005 to 2006, commercial fisheries production was 139 mt and subsistence production was 239 mt.

A significant conclusion made from examining the HIES results is that the estimates of coastal fisheries production are reasonably close to those of the Situation and Outlook Report (MMR 2008). The studies give similar results for coastal commercial fisheries (variance within 7%) and for subsistence fisheries (variance within 20%).

The Gillett (2009) study considered the results of the HIES and the Situation and Outlook Report (MMR 2008), 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 Cook Islands in the mid-2000s was about 133 mt (worth about NZ$1.4 million to fishers), and about 267 mt (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 Cook Islands is thought to be reasonably accurate.

There has not been a comprehensive attempt to re-estimate coastal fisheries production in Cook Islands in the last 10 years. However, some external factors can be identified that affect coastal fisheries production in the country.

The population structure of Cook Islands is changing. Between 2007 (the focus year for the Gillett (2009) survey) and 2014 (the focus year for the present survey) the population of the country has declined by 0.9% (SPC PRISM website data). In addition, Cook Island residents are gravitating to Rarotonga, where fish consumption rates are lower than in the outer islands. Other changes affecting coastal fisheries include the following:

- The number of public servants was significantly reduced in the period 2008/2009, but has been gradually increasing again in recent years.
- The FAD programme expanded, resulting in greater catches of pelagic species by small-scale fishing.
- The number of game fishing operators that sell their catch is increasing. Wichman (2012) reports that there are 17 game fishing/fishing charter operations in Cook Islands.

- Over the last few years the island councils relaxed bans on tridacna exports to Rarotonga, and the recent annual trade is significant.
- Harvests of trochus between 2011 and 2015 were around 19 mt annually.
- The number of flights from the northern islands to Rarotonga has decreased.

Exports are an important component of coastal commercial fisheries in Cook Islands. MFEM (2015) states that, in 2014, NZ$91,000 worth of aquarium fish[1] were exported, and the annual average over the 2010–2014 period was NZ$115,000. According to staff of the Ministry of Marine Resources, harvests of trochus between 2011 and 2015 were around 19 mt annually, with each harvest worth approximately NZ$104,500 to fishers (all trochus are exported).

It is apparent from the above information that several sources of data were available to make a reasonably good estimate of coastal catches for 2007. Projecting that catch to 2014 involves more speculation, but it can be stated with some confidence that the coastal commercial catch for 2014 was around 150 mt. Considering price information from various documents, and from MMR staff, that catch was worth approximately NZ$1.7 million to fishers.

Coastal Subsistence Catches

The information above suggests that the coastal subsistence catch in the country has not expanded in the previous decade. It is therefore estimated that the production from coastal subsistence fisheries in Cook Islands in 2014 was about 276 mt. Using the farm gate method for valuing subsistence production, this production would be worth around NZ$2 million to fishers.

Locally Based Offshore Catches

In recent years a domestic commercial fishing company has carried out longline fishing, with one or two Rarotonga-based longline vessels operating every year. In 2013 the one operating vessel offloaded 105 mt of fresh catch. In 2014 two longliners offloaded 194 mt of fresh catch (Brown 2015). At a dockside price of NZ$15/kg, the 2013 production equates to NZ$1.6 million, and the 2014 catch is worth NZ$2.9 million.

1 FOB value - this needs to be reduced by approximately 50% to give price to fishers (i.e. NZ$45,500).

Foreign-Based Offshore Catches

The foreign-based offshore catch in Cook Islands is taken to be the total offshore catches minus the small amount of catches made by the Rarotonga-based longliners. OFD (2015) describes the two types of foreign-based vessels operating in the Cook Islands zone:

- Purse seiners: only purse seine vessels under the Treaty on Fisheries between the Governments of Certain Pacific Islands States and the Government of the United States of America (the US Tuna Treaty) were authorised to fish in Cook Islands waters in 2014.
- Longliners: fourteen Cook Islands-flagged longline vessels and 24 non-Cook Island-flagged vessels fished in the Cook Islands zone in 2014, the latter comprising Chinese- and FSM-flagged vessels that operate out of Pago Pago, American Samoa.

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries Commission have been made by the Forum Fisheries Agency using data sourced from SPC's Oceanic Fisheries Programme. The volumes and values can be determined using the "catch by national fleet" and "value by national fleet" spreadsheets of FFA (2015). As the values given by FFA are based on prices at overseas destinations, Tables 6-1 and 6-2 adjust those prices to equate to values inside the EEZ of Cook Islands.

Table 6-1: The Volume/Value of the Foreign-Based Purse Seine Catch

	2010	2011	2012	2013	2014
Purse seine catch (mt)	262	1,387	13,160	8,338	12,765
Delivered value of catch (US$)	338,034	2,353,968	28,287,451	17,460,308	19,110,458
In-zone value of catch (US$)	321,132	2,236,270	26,873,078	16,587,292	18,154,935

Source: FFA (2015)

Table 6-2: The Volume/Value of the Foreign-Based Longline Catch

	2013	2014
Total volume longline catch in the zone (mt)	8,054	7,771
Volume local longline catch in the zone (mt)	105	194
Volume foreign-based longline catch in the zone (mt)	7,949	7,577
Value of the longline catch, adjusted for bycatch and delivery (US$)	33,107,585	38,998,919

Source: FFA (2015)

From the above tables it can be seen that, in 2014, the offshore catches in Cook Islands waters made by foreign-based vessels were 20,342 mt, worth US$57,153,854 (NZ$73,156,933).

Freshwater Catches

The only readily available information relevant to estimating total freshwater fish production in Cook Based on limited data the national annual freshwater catch is estimated to be 5 mt 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, of NZ$37,500.

Aquaculture Harvests

In Cook Islands the most significant type of aquaculture presently is pearl farming. Pearl production reached maximum production about 15 years ago. At its peak in 2000 there were 81 farms with 2 million shells in the water, providing a pearl yield reportedly worth NZ$18 million annually, accounting for more than 90% of national exports and 20% of GDP (MMR 2012). Production has since declined, due to bacterial infection and declining prices in the global pearl market (Hambrey 2011). In 2014 there were about 10 active pearl farms, with a further 14 farms operating at a minimal level (Brown 2015).

According to the Cook Islands Pearl Authority (CIPA; T. McFadzien, per. com. September 2015) the annual benchmark surveys for pearl production were discontinued in 2010. Consequently, there is a wide range in current estimates of the number of saleable pearls produced annually, and the associated value. For 2014 these ranged from 37,169 pearls (Brown 2015) to 56,000 pearls (MMR staff and a large pearl retailer). Cited 2014 prices received by pearl farmers ranged from NZ$16.60 (CIPA) to NZ$20 (MMR staff). The official export statistics of Cook Islands show NZ$364,000 worth of pearl exports,[2] but, as pointed out by several individuals associated with the pearl trade, only about half of the pearls are exported. The actual pearl export situation appears to be that most of those pearls that would be categorised as non-exported are informally exported (i.e. hand carried and undeclared) or sold to tourists who subsequently carry them out of the country. If 50,000 pearls, worth NZ$20 per pearl to the farmers, were produced in 2014, that equates to a value of NZ$1 million.

2 At NZ$20 per pearl this equates to 18,200 pearls exported.

There were other types of aquaculture production in 2014. According to MMR staff this consisted of the following:

- Tridacna clams: about 30,000 were produced during the year, of which 2,000 were exported[3] (farm gate value NZ$5/clam), with the non-exported clams being used for reef re-stocking.
- Milkfish: production is for both food (value as per subsistence catches) and bait (NZ$2.50/kg). 2014 production is estimated to be 10 mt, worth NZ$70,000.
- Tilapia: a small amount of tilapia is reportedly being produced at one farm. Details of production are not readily available. Production for the purpose of this study is deemed to be 2 mt, worth NZ$15,000 to the farmer.

From the above, it appears that the 2014 Cook Islands aquaculture production was about 12 mt, plus 52,000 pieces, worth, in total, NZ$1,095,000.

Summary of Harvests

From the above sections, a crude approximation of the annual volumes and values[4] of the fishery and aquaculture harvests in 2014 can be made (Table 6-3).

Table 6-3: Fisheries and Aquaculture Harvest in Cook Islands in 2014

Harvest Sector	Volume (mt, and pcs)	Value (NZ$)
Coastal Commercial	150	1,700,000
Coastal Subsistence	276	2,000,000
Offshore Locally based	194	2,900,000
Offshore Foreign-based	20,342	73,156,933
Freshwater	5	37,500
Aquaculture	52,000 pcs and 12 mt	1,095,000
Total	**52,000 pcs and 20,979 mt**	**80,889,433**

This value of production in 2014 is significantly larger that the NZ$14 million fishery and aquaculture harvest in 2007 reported by Gillett (2009). In 2007 there was no authorised offshore foreign-based fishing in the zone. Conversely, in 2007 the aquaculture harvest was worth three-times that of the 2014 production.

3 The same staff stated that about 4,000 tridacna clams were exported in 2013, but CITES export records show only 603 live tridacna were exported that year from Cook Islands.

4 The values in the table are dockside, farm gate, or in-zone prices.

Figures 6-1 and 6-2 show the volumes and values of the 2014 Cook Islands fisheries production. Aquaculture is not shown in the volumes figure due to the use of mixed units (pieces and mt).

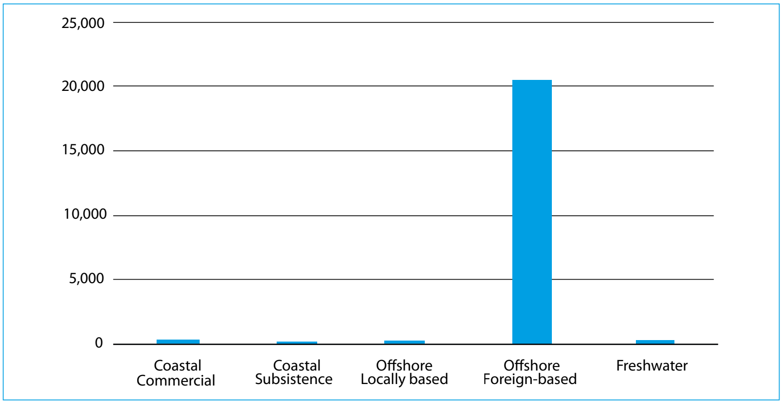


Figure 6-1: Cook Islands Fisheries Production 2014 by Volume (mt)

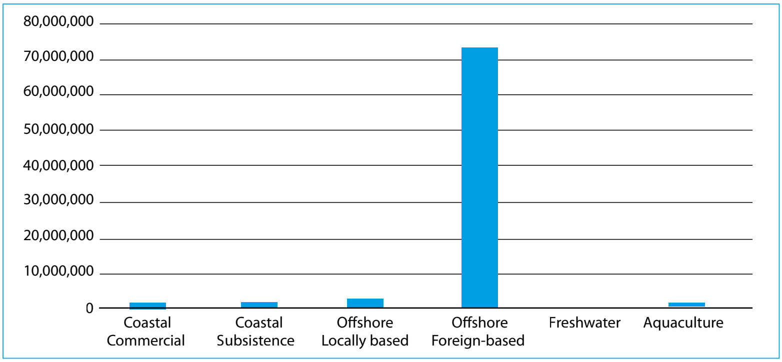


Figure 6-2: Cook Islands Fisheries Production 2014 by Value (US$)

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007 and the present study focuses on 2014. The estimated fishery production levels for Cook Islands from those three studies are presented in Table 6-4.[5]

5 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 (mt, and pcs where indicated)	Value (NZ$)
Coastal Commercial	1999	80	19,500,000
	2007	133	1,400,000
	2014	150	1,700,000
Coastal Subsistence	1999	795	2,200,000
	2007	267	1,700,000
	2014	276	2,000,000
Offshore Locally tbased	1999	75	750,000
	2007	3,939	7,850,000
	2014	194	2,900,000
Offshore Foreign-based	1999	300	770,000
	2007	0	0
	2014	20,342	73,156,933
Freshwater	1999	n/a	n/a
	2007	5	50,000
	2014	5	37,500
Aquaculture	1999	n/a	n/a
	2007	190,000 pcs and 3 mt	3,040,000
	2014	52,000 pcs and 12 mt	1,095,000

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the 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 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 Household income and Expenditure Survey), rather than a decrease in the amount of fish being harvested. In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better quality data) are likely to 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 pearl". The official contribution of this sector to GDP is given in Table 6-5.

Table 6-5: The Official Contribution of Fishing and Pearl to GDP (NZ$ millions)

	2010	2011	2012(r)	2013(r)	2014(p)
Fishing and pearl contribution to GDP	10.3	9.3	10.8	16.2	22.8
Total GDP of Cook Islands	354.1	362.4	372.9	367.7	382.8
Fishing and pearl as a % of GDP	2.9%	2.6%	2.9%	4.4%	6.0%

(r) = Revised figures; (p) = Provisional figures
Source: Statistics Office unpublished data

Method Used to Calculate the Official Fishing Contribution to GDP

MFEM (2015) provides some details on the GDP methodology:

> The GDP compilation methodology included additional information such as the benchmark data from the 2001 Agriculture Census, 2005 Household Expenditure Survey, and the 2006 Census of Population and Dwellings. Other data include: annual financial statements for public enterprises; adjustment data on fishing from the Ministry of Marine Resources; and annual value added to output ratios based on VAT data. Improvements in coverage have recently been made for agriculture, forestry and hunting, fishing, food and beverages manufacturing, financial intermediation, and education services. There are three basic approaches used in the compilation of GDP, namely the Production, Expenditure and Income approach. Currently the Production Approach is being used for the compilation of the Cook Islands GDP. Generally the GDP in this approach is calculated as, the total Gross Output less Intermediate Consumption (IC).

The staff of the Statistics Office provided some additional details on the method used to calculate the fishing contribution to GDP, as follows:

- The "fishing and pearl sector" is divided into three components: commercial, unincorporated, and subsistence. The actual values added for

2014 for the three components is not readily available from the staff of the Statistics Office.

- VAT data is used to estimate the gross output and intermediate consumption for commercial and unincorporated components.
- The 2005 HIES is used to estimate the value added for the subsistence components. That HIES could have been distorted as a result of an outbreak of ciguatera fish poisoning that year.
- All pearl farms are registered for VAT and there are incentives to report properly.
- For pearl farming a value added ratio of 40% is assumed. FOB export values are used as a basis for valuing pearl production.

Alternative Estimate of Fishing Contribution to GDP

Table 6-6, below, represents an alternative to the official method of estimating fishing contribution to GDP in 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 6-6 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 6-6: Fishing Contribution to GDP in 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production (NZ$, from Table 6-3)	VAR	Value Added (NZ$)
Coastal Commercial	1,700,000	0.65	1,105,000
Coastal Subsistence	2,000,000	0.80	1,600,000
Offshore Locally based	2,900,000	0.20	580,000
Freshwater	37,500	0.90	33,750
Aquaculture	1,095,000	0.45	492,750
Total (NZ$)	**7,732,500**	---	**3,811,500**

Source: Production section of this chapter, and Appendix 3

The NZ$3.8 million value added from the fishing sector represents 1% of the NZ$382.8 million GDP of Cook Islands in 2014. The Gillett (2009) recalculation of the 2007 fishing contribution to GDP estimated a value added of NZ$4 million.

The 2014 fishing contribution to GDP in Table 6-6 (NZ$3.8 million) is considerably less than the official fishing contribution to GDP of NZ$22.8 million given in Table 6-5. Given the lack of details available about the official methodology (i.e. not knowing the actual values added for the three components of fishing/pearl), it is difficult to speculate about the quantum of the difference. Two possibilities are: (a) the use of the gross value of production from a given type of fishing as the value added (i.e. not subtracting the intermediate consumption); and (b) inclusion of the activities of offshore fishing vessels that are not based in the country.

6.3 Exports of Fishery Production

The official overseas trade statistics of Cook Islands (MFEM 2015) provide the export figures of the country, including the fishery exports (Table 6-7).

Table 6-7: Value of Fishery Product Exports (NZ$ thousands)

	2011	2012	2013	2014
Live fish	147	96	19	91
Fish fresh or chilled	2,390	5,312	259	105
Pearls	369	259	142	364
Pearl shells	213	105	49	0
All fishery exports	3,119	5,772	469	560
All exports	3,956	6,552	12,984	21,276
Fishery exports as a % of all exports	78.8%	88.1%	3.6%	2.6%

Source: MFEM (2015)

For comparison purposes, Statistics Office (2007) reported that fisheries exports represented 79.4% of all exports in 2007.

"Live fish" in the table are fish in the aquarium trade. "Pearl shells" appear to be "mother of pearl shells", which includes trochus. There is confusion around the "Fish fresh or chilled" category. The amounts for this category do not correspond to what is offloaded and exported from Rarotonga-based longliners (Brown 2015), nor to catches in Cook Islands waters (above in this report), nor to catches by Cook Islands-flagged vessels (MMR 2015). The cited amounts of "Fish fresh or chilled" are likely to include some (but not all) of the catch that is being transshipped by Cook Islands-flagged vessels in ports outside Cook Islands.

6.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

Brown (2015) states that the access fees for the financial year 2014/2015 collected for the purse seine fishery are NZ$9.7 million, and NZ$1.7 million for the longline fishery.[6] Some of these fees appear to be for access by domestic vessels. All of the purse seining in that year was foreign, but in 2014 one-third of the longliners fishing in the zone were Cook Islands-flagged (OFD 2015). If it is assumed that one-third of the NZ$1.7 million in access fees is for non-foreign fishing, then the access fees for foreign longlining in the Cook Island zone for 2014 was NZ$1.1 million, making total access fees for foreign fishing (purse seining and longlining) NZ$10.8 million.

According to the Cook Islands Government Quarterly Financial Report (MFEM 2015) in FY 2014/2015 government "operating revenue" was NZ$94.9 million. Therefore, the NZ$10.8 million of access fees for foreign fishing represents 11.4% of the operating revenue for FY 2014/2015.

For comparison purposes, Gillett (2009) reported that, in 2007, access fees for foreign vessels represented about 0.4% of "total crown receipts".

Other Government Revenue from Fisheries

Other major sources of government revenue from fisheries are fees from fines for illegal fishing and licensing fees from Cook Islands-flagged offshore fishing vessels.

Brown (2015) indicates that, for FY 2014/2015, there were "NZ$1.3 million for out-of-court settlements for fisheries infringements". OFD (2015) states that, in 2014, 11 vessels were suspected of IUU fishing. Two were boarded in Cook Islands EEZ and shark fins were found on board. One purse seiner and seven longliners were detected fishing without a licence inside the Cook Islands EEZ. One Cook Islands-flagged vessel was found operating on the high seas with a non-functional VMS.

Figures for government revenue from licensing Cook Islands-flagged offshore fishing vessels are not readily available. In the section above this is assumed to be around NZ$566,000.

6 The Cook Islands Government Quarterly Financial Report (MFEM 2015) gives a different amount for FY 2014/2015 (in NZ$ thousands) "Fishing Licenses $4,818; Fisheries Catch Rev $1,777; Fisheries US Treaties $1,046", or a total of NZ$7,641,000.

6.5 Fisheries-Related Employment

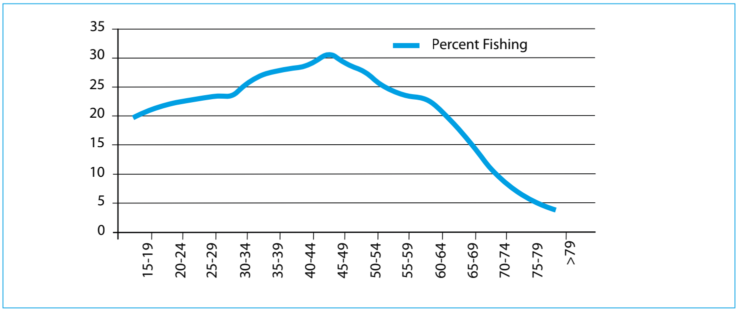
The Cook Islands 2011 Census of Population and Dwellings (Statistics Office 2011) contains a considerable amount of information on fisheries-related employment. Table 6-8 indicates the involvement of households in fishing and pearl farming. 42.4% of households in Cook Islands participate in fishing. However, involvement in fishing appears to be declining. In 2011 57.6% of households had not engaged in any level of fishing activity, whereas the figure in the previous census, in 2006, was 50.6%.

Table 6-8: Fishing and Pearl Farming Households by Island

Location of Household	Number of total households	Number involved in fishing	% involved in fishing	Number involved in pearl farming	% involved in pearl farming
RAROTONGA	3154	951	30.2%	17	0.5%
OTHER SOUTHERN	939	661	70.4%	-	-
Aitutaki	482	307	63.7%	-	-
Mangaia	170	140	82.4%	-	-
Atiu	137	92	67.2%	-	-
Mauke	92	73	79.3%	-	-
Mitiaro	58	49	84.5%	-	-
NORTHERN	279	243	87.1%	42	15.1%
Palmerston	13	11	84.6%	-	-
Pukapuka	101	88	87.1%	-	-
Nassau	13	13	100.0%	-	-
Manihiki	78	70	89.7%	38	48.7%
Rakahanga	21	18	85.7%	3	14.3%
Penrhyn	53	43	81.1%	1	1.9%
ALL COOK ISLANDS	**4372**	**1855**	**42.4%**	**59**	**1.3%**

Source: Statistics Office (2011)

The 2011 census also provides information about the age structure of fishers. Figure 6-3 shows that, for those residents that are engaged in gardening, tending livestock and fishing as an unpaid activity, the percentage participation is strongest in the mid-40s age group (about 30% of that age group participates in fishing), whereas there is weaker participation by teenagers (20%) and by the mid-20s age group (24%).



Source: Statistics Office (2011)

Figure 6-3 : Participation in Fishing by Age

The usefulness of the 2011 census for fisheries purposes is affected by "fishing" not being defined in the census reports (i.e. it is not clear whether engaging in "fishing" means someone who fishes at least once per week, once per month, and so on). Another drawback of the 2011 census is the use of the aggregated category "Agricultural & Fishery Workers", meaning it is difficult to identify, for example, formal employment in fisheries.

The employment situation with respect to subsistence fishing is very different between Rarotonga and the outer islands:

- An SPC survey (Kronen and Solomona 2008a) on Mangaia indicated that almost all households (92%) were engaged in fisheries, with between 1 and 2 fishers in each. There were 309 fishers on Mangaia, including 148 women and 161 men fishers. One-third (111) of all fishers were exclusive men engaging in finfish fishing, and about one-third (101) were exclusively women engaged in invertebrate fishing. The remaining fishers were generally participating in both kinds of fishing.
- A similar SPC survey (Kronen and Solomona 2008b) on Rarotonga showed that less than half of all households (44%) were engaged in fisheries, with an average of one fisher per every second household. These figures also include sport fishers and households having a motorised boat used for weekend trolling outside the outer reef. About half (155) of all fishers were predominantly men targeting finfish, and very few women specialised in finfish fishing only. About one-quarter of fishers (69) were women involved exclusively in invertebrate fishing. The remaining fishers were generally participating in both kinds of fishing.

SPC (2013) indicates that, of fishers in Cook Islands that target both finfish and invertebrates, 62% are men and 38% are women.

Forum Fisheries Agency unpublished data on employment in Cook Islands related to the tuna industry indicate that, in 2014, there were no local crew working on tuna vessels, but seven people were employed in "processing and ancillary" activities. Five observers worked on tuna vessels under national and regional programmes.

Barclay and Cartwright (2007) provide some insight into tuna-related employment, indicating that Cook Islanders' historical aspirations for the employment in the tuna industry (at their height in the 1990s) had deflated by the early to mid-1990s, particularly for employment on fishing vessels. Cook Islands has a labour shortage: there is not the same unemployment problem that exists in many other Pacific Island countries, such as Fiji, Papua New Guinea and Solomon Islands. Work on fishing vessels is physically hard, and the life can be very uncomfortable. Some of the vessels in the northern fishery stay out fishing for months at a time, and the pay is not high for ordinary crew. Some Cook Islanders have taken up employment opportunities on some of the small longline vessels operating from Rarotonga that do not stay out at sea for long periods, and in processing facilities. Others are employed in commercial sport fishing.

6.6 Levels of Fishery Resource Consumption

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

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

Bell et al. (2008) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both subsistence and cash acquisitions. 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.

There has been a significant amount of work on fishery resource consumption on Rarotonga, as described below:

- 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 showed a decrease of total seafood consumption over the 1989 to 2001 period, from 317.7 g to 270.7 g per capita per day[7] (which represents an annualised decrease from 116.0 kg to 98.8 kg per capita). It was thought that causes of the reduction included 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 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 a 2001 survey by Teina Tuatai. The results of the 2006 survey indicated a constant decline in average daily per capita consumption rates since 1989, from 318 g in 1989 to 271 g in 2001, and 176g in 2006[8] (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, such as ciguatera, marine protected areas, 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.

The above studies focused exclusively on Rarotonga. SPC carried out some studies in Cook Islands that compared seafood consumption in Rarotonga with consumption on other islands in the country. Box 6-1 gives the results from Rarotonga and Mangaia.

7 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).

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

Box 6-1: Seafood Consumption on Two Islands

Rarotonga:

Quantity fresh fish consumed (kg/capita/year)	31.66	(±4.62)
Frequency fresh fish consumed (times/week)	1.85	(±0.17)
Quantity fresh invertebrate consumed (kg/capita/year)	1.43	(±0.61)
Frequency fresh invertebrate consumed (times/week)	0.33	(±0.08)
Quantity canned fish consumed (kg/capita/year)	10.88	(±2.02)
Frequency canned fish consumed (times/week)	1.16	(±0.19)

Mangaia:

Quantity fresh fish consumed (kg/capita/year)	65.71	(±13.39)
Frequency fresh fish consumed (times/week)	3.16	(±0.26)
Quantity fresh invert. consumed (kg/capita/year)	7.54	(±2.05)
Frequency fresh invertebrate consumed (times/week)	0.72	(±0.11)
Quantity canned fish consumed (kg/capita/year)	15.05	(±3.22)
Frequency canned fish consumed (times/week)	1.13	(±0.19)

Source: Kronen and Solomona (2008a, 2008b)

Two significant aspects affecting fish consumption on Rarotonga have emerged in recent years: ciguatera and tuna from longliners:

- Several documents (e.g. Moore 2006, MMR 2008, MMR 2010) point to a decrease in fish consumption on Rarotonga. A study by Rongo and Van Woesik (2011) proposed that an increase in ciguatera fish poisoning occurrence 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.

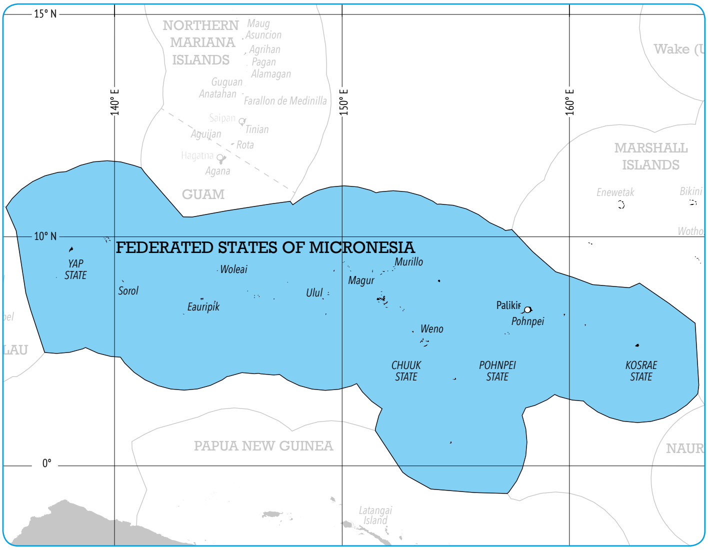
- A major change in fish consumption in Rarotonga since the early 2000s has been caused by the availability of fish from longliners. MMR (2008) estimated that the domestic market absorbs around 40 to 50 per cent of total catch from the longline vessels based in Rarotonga. In 2007 between 120 mt and 150 mt of whole fish equivalent was sold domestically to the hospitality industry and the local population on Rarotonga. Brown (2015) found that the domestic longliners were responsible for putting 90 mt and 171 mt of fish on the Rarotonga market, in 2013 and 2014, respectively.

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 report are as follows:

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.51	1.42	1.54	1.36	1.32	1.39	1.30	1.29	1.21	1.22	1.28

7 Federated States of Micronesia



7.1 Volumes and Values of Fish Harvests in Federated States of Micronesia (FSM)

Coastal Commercial Catches in FSM

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

- Smith (1992) reviewed the FSM fishery resources for the Forum Fisheries Agency. He concluded that in FSM, "the available information on inshore fisheries production is incomplete and often vague."
- Dalzell et al. (1996) used information from the 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 mt (worth US$1.5 million), and subsistence production of 6,243 mt (worth US$11.2 million).

- Gillett and Lightfoot (2001) considered the Dalzell estimate and four other sources of information, and then proposed coastal commercial fisheries production for the late 1990s of 5,000 mt (worth US$14.5 million) and subsistence production of 5,000 mt (worth US$10 million).
- Kronen et al. (2009) 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 2009) examined the above studies and considered other information, including the following:

- A fisheries survey in Pohnpei covering the period 1998–2008 (Rhodes and Tupper 2007, and Rhodes 2008)
- A follow-up on the Rhodes study (George 2008)
- The results of the 2005 FSM household income and expenditure survey
- Comments and feedback on the Gillett and Lightfoot (2001) estimate
- Official and non-official export data
- Changes in the FSM population structure

The report of the Gillett (2009) study states that the available information is totally inadequate for making even a rough estimate of coastal fisheries production in FSM. Nevertheless, with the "obviously weak methodology", the study ventured a very rough estimate for annual coastal commercial fisheries production in FSM for the mid-2000s of about 2,800 mt (worth US$7.6 million to fishers), and annual coastal subsistence fisheries production of about 9,800 mt (worth US$15.7 million to fishers).

Since 2008 some additional documentation on coastal fisheries in FSM has become available, including the following:

- Hopkins and Rhodes (2010) indicate that Pohnpei is currently extracting nearly 725 mt annually from reefs, with about 500 mt of coral reef fish from commercial fishing and 227 mt from subsistence fishing. They state: "A roughly equal share of reef fish was obtained by being caught (27%), bought (35%) or given to them (33%). Only 5% of households indicated they had obtained fish through barter or trade."

- Rhodes, et al. (2011) state that there are about 521 mt of locally marketed reef fish annually in Pohnpei and 60 mt in Yap.
- Cuetos-Bueno (2014) indicates about 1 million pounds (453 mt) of reef fish is being caught for commercial purposes in Chuuk lagoon each year, with half being sold at Weno's urban markets and half being exported.
- OFA (2015) states that in FY 2014 catches of reef fish in Pohnpei were 95.7 mt and catches of pelagic fish were 44 mt.
- Rhodes et al. (2015) states that Pohnpei and surrounding atolls have a finfish yield of about 4,068 mt per year.
- SPC's PRISM website data shows that the population of FSM decreased 1.8% between 2007 and 2014.
- Several studies point to a decline in recent years in the accessible fisheries resources of FSM (e.g. Kostka and Gavitt 2006, CCIF 2013, Cuetos-Bueno 2014, Rhodes et al. 2015).

In November 2015 another type of information became available to the present study. In 2013/2014 a household income and expenditure survey was carried out in FSM (Statistics Division 2014). The 2013/2014 FSM HIES was more fisheries-oriented than previous HIES work in FSM and other Pacific Island countries (Box 7-1).

Box 7-1: Improved HIES for Fisheries Purposes

In 2013 SPC's Statistics for Development Division made major changes to the type of household income and expenditure survey it promotes in the Pacific Islands region. The new type of HIES is standardised across the countries in the region with respect to the questions asked, sampling methodology, data set, outputs, and reporting. Another feature of the new type of HIES is that the survey is more fisheries-relevant, especially for subsistence and small-scale commercial activities. It is easier to capture home production and household income from fisheries and to disaggregate by various types of catch (i.e. ocean fish, lagoon fish, invertebrates). Since 2013 the new type of HIES has been used in FSM, Nauru and Palau.

Source: M. Sharp, SPC (per. com. November 2015)

In November 2015 staff of SPC's Statistics for Development Division, with permission from FSM's Statistics Division, carried out additional analysis on the data from the recent FSM HIES. This resulted in estimates of cash expenditure by households on various types of coastal fishery products, and imputed a value of coastal fishery products acquired though subsistence activities.

By taking market prices in the four FSM states for various categories of fish prices (kindly supplied by the Statistics Division), the HIES-generated fish values, above, could conceivably be converted into volumes of coastal fish consumed domestically (Table 7-1). However, numerous (possibly tenuous) assumptions must be made for this conversion, so the results must be viewed with some degree of scepticism. Proceeding with this methodology is justified by the lack of alternatives.

Table 7-1: HIES Estimates of Domestically Consumed Coastal Fishery Products (mt)

	Yap		Chuuk		Pohnpei		Kosrae	
	Cash	Non-cash	Cash	Non-cash	Cash	Non-cash	Cash	Non-cash
Ocean fish	78	127	251	197	219	68	13	213
Reef fish	64	831	232	1,241	368	499	54	125
Invert	2	50	8	83	5	111	5	10

Source: HIES unpublished data

The FSM coastal fisheries production from the 2013/2014 HIES data, above, can be summed across the four states and types of fishery products. This is given in Table 7-2.

Table 7-2: FSM Coastal Production from HIES Data

	Volume (mt)
Ocean fish	1,166
Reef fish	3,414
Invertebrates	274
Total	**4,854**

Some comment is required on the 2013/2014 HIES results. An important issue in the HIES data is that the cash purchases in Chuuk of ocean fish seem large. A researcher from the University of Guam, who spent most of 2014 in Chuuk monitoring fish catches, indicated that ocean fish catches in Chuuk Lagoon are likely to have been less than 100 mt during 2014

(J. Cuetos-Bueno, per. com. November 2015). A fisheries specialist with long historical involvement with Chuuk fisheries supplied some additional information on the issue:

> The major market is the population center of Moen (Weno) where most of the money is and although there are many outboards in Chuuk lagoon, due to the large size of the lagoon and high cost of fuel, travel to chase skipjack would not appear to be economically feasible year-round. During my visit in early 2014 I did not see or hear of any ongoing FAD program that might have a positive influence on catch volumes. Chuuk small boat fishermen do not use artisanal pole-and-line techniques, and thus I would not expect production from outboards in Chuuk lagoon to reach volumes caught on Maina Banks and marketed in Tarawa for example. There has been no purse seine transshipment for years in Chuuk lagoon. Although there are several former Japanese longliners present in Chuuk, these are operated as passenger/cargo vessels and I believe their export from Japan required them to not be outfitted for fishing or carry fishing gear. (M. McCoy, per. com. November 2015)

By contrast, the Chuuk commercial reef fish catches from the HIES data are close to the results obtained from a fishery study. Preliminary results from a study of fishery production in Chuuk Lagoon suggest a commercial catch of about 453 mt[1] of reef fish, about half of which is exported (Cuetos-Bueno 2014) – therefore 226 mt would be available for domestic consumption and be included in the HIES. The HIES generated amount for Chuuk State was very close to that amount: 232 mt.

The HIES implies that Chuuk State catches 41% of the FSM coastal fishery catch that is domestically consumed, while Chuuk represents 47% of FSM's population, according to the 2010 census. Census information may also help reconcile at least part of the discrepancy in the Chuuk tuna catches between the Cuetos-Bueno work and the HIES. The HIES showed over twice the amount of commercial tuna in Chuuk State as that shown by Cuetos-Bueno in Chuuk Lagoon. The census shows that the population of Chuuk Lagoon is 36,152, and the population of the outer islands is 12,502. FAO studies on small-scale tuna fishing in the world (Gillett 2005, Gillett 2011) indicated relatively high catches of tuna by small-scale fishing in the outer islands of FSM. Accordingly, Chuuk State is likely to produce significantly more tuna than Chuuk Lagoon alone.

1 Subsequent communication with the author indicates it is likely to have peaked at that amount some years back, due to the ongoing collapse of exports. The non-exported catch (i.e. that reported in the HIES) is likely to have remained the same.

Some observations can be made about the results of the fisheries studies cited above and the 2013/2014 HIES:

- Some ground truthing of the 2013/2014 FSM HIES showed very good concurrence with respect to Chuuk's commercial catch of reef fish, whereas the HIES suggested a larger tuna catch.
- The estimates by Fisheries and Aquaculture (OFA 2015) of the coastal catches in Pohnpei seem very low relative to the other studies, and several researchers are sceptical of those results.
- The available information from the fisheries studies during the last decade do not contribute much additional information on the level of catches in the FSM outer islands, and contribute only a limited amount of information on the FSM subsistence fisheries away from Pohnpei.
- The fishery studies seem to be focused on reef fish, and do not appear to include pelagic fish caught by small-scale fishers (which are considered as part of coastal fisheries in the present study).

Few definitive conclusions can be made on national coastal fisheries production from the above (often conflicting) information. However, making a reasonably informed but crude estimate of the production level may encourage others to produce better estimates. Accordingly, the following can assist in estimating coastal fisheries production of FSM:

- Pohnpei and nearby atolls (i.e. Ant, Pakin) seem to be the only major location where results of FSM fisheries studies are available that cover both commercial and subsistence fisheries.
- The population of Pohnpei is about one-third that of FSM.

There appear to be two divergent possibilities for estimating FSM's annual coastal fishery production:

1. Expanding the Pohnpei coastal fisheries production by that state's share of the population to arrive at the national production is not a robust methodology for many reasons – however applying this method with the Rhodes et al. (2005) results gives a national production of 12,270 mt of reef fish (i.e. 8,589 mt commercial, 3,681 mt subsistence). These figures do not consider ocean fish and exports.
2. Using the 2013/2014 HIES data will result in an estimate of 4,854 mt of domestically consumed coastal fishery products (i.e. 1,299 mt commercial, 3,555 mt of subsistence). These figures do not consider exports.

There is little fisheries information available to enable a choice between the two above approaches. The assumption that the Pohnpei situation is typical of the entire country (possibility #1 above) appears dubious, yet this assumption would be necessary in the approach. Accordingly, possibility #2 will be used here.

The volume of the subsistence catch in the HIES is similar to that of the subsistence catch by the Pohnpei expansion approach. Also, as discussed above, the HIES gave an amount for non-exported reef fish in Chuuk very close to what the University of Guam researcher obtained. These two observations add to the credibility of the HIES results, and to the estimates of coastal fisheries production in the present study.

The HIES coastal fishery production amounts need to be adjusted to account for exports:

- Unpublished export data from the Statistics Division show that an annual average of 165 mt of coastal products (reef fish, crab/lobster and trochus) were exported over the period 2012–2014.
- Rhodes et al. (2011) show reef fish exports from the FSM states, derived from a variety of studies. Those total about 261 mt annually.

Adjusting the 2013/2014 HIES data for exports results in a 2014 coastal fisheries production of 5,280 mt (1,725 mt commercial, 3,555 mt subsistence). Using the HIES prices discounted to be prices to fishers results in a value of US$5.0 million for the commercial catch and US$8.8 million for the subsistence catch.

These estimates for 2014 are less than those of the Gillett (2009) study: 2,800 mt commercial and 9,800 mt subsistence. The much smaller amount for subsistence fishing in 2014 is likely to be due to improved information from the 2013/2014 HIES, rather than due to a major change in the fishery.

Coastal Subsistence Catches

Following from the above section, a crude estimate of the coastal subsistence catch of FSM is 3,337 mt, worth US$6.1 million to fishers. The fact that the two approaches for estimating FSM fisheries production cited above give similar results for subsistence catches adds some credibility to this estimate.

Locally Based Offshore Catches

To use the data available to the present study to estimate the catches by FSM-based offshore vessels requires the assumption that all FSM purse seiners are locally based. The volumes and values of FSM-based offshore fishing can be calculated using tuna catches given in Graduate School (2015), sourced from NORMA and tuna prices from the Forum Fisheries Agency (Table 7-3).

Table 7-3: Volumes and Value of FSM-based Offshore Fishing

	2012	2013	2014
Tuna volume locally based longliners (mt)	1,577	1,936	2,763
Tuna volume FSM purse seiners (mt)	36,233	24,182	38,075
Value of locally based longliners adjusted for transport and bycatch (US$)	12,852,550	15,778,400	22,518,450
Value of locally based purse seiners catch adjusted for transport (US$)	59,784,450	39,900,300	62,823,750
Total volume locally based purse seiners and longliners (US$)	37,810	26,118	40,838
Total value locally based purse seiners and longliners (US$)	72,637,000	55,678,700	85,342,200

Prices from FFA (2015)
Source: Tuna volumes from Graduate School (2015) and NORMA (unpublished data)

Foreign-Based Offshore Catches

To use the data available to the present study to estimate the foreign-based catches in the FSM zone requires the assumption that all the catches by FSM-based longliners (given above) are made in the FSM zone. The foreign-based offshore catches can be calculated using tuna catches and prices in FFA (2015), in conjunction with the catches of FSM-based offshore fishing from the above section (Table 7-4).

Table 7-4: Foreign-Based Offshore Catches in the FSM Zone

	2012	2013	2014
All purse seine in FSM zone (mt)	185,916	210,453	135,871
FSM purse seine in FSM zone (mt)	11,047	8,557	15,981
Foreign-based purse seine in FSM zone (mt)	174,868	201,895	119,891
All longline in FSM zone (mt)	3,297	2,984	6,179
Locally based longline in FSM zone (mt)	1,577	1,936	2,763
Foreign-based longline in FSM zone (mt)	1,720	1,048	3,416
Volume pole-and-line catch in FSM zone (mt)	2,489	2,337	1,175
Value of foreign-based purse seine adjusted for delivery (US$)	288,533,018	333,126,902	197,819,746
Value of foreign-based longline adjusted for delivery and bycatch (US$)	14,018,176	8,542,660	27,837,513
Value pole-and-line catch in FSM zone adjusted for delivery (US$)	7,001,586	4,745,475	2,490,821
Volume all foreign-based fishing in FSM zone (mt)	179,077	205,280	124,481
Value all foreign-based fishing in FSM zone (mt)	309,552,781	346,415,036	228,148,080

Source: FFA (2015) and the preceding section

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

Aquaculture Harvests

Amos et al. (2014) indicate that FSM aquaculture activities consist of corals, giant clams, sponges, blacklip pearl oyster and sandfish. To this could be added a small amount of seaweed culture. Currently, all significant FSM aquaculture activities are carried out in Kosrae and Pohnpei States.

Coral culture is being carried out in both Pohnpei and Kosrae. According to the two producers, a crude estimate of the annual production in 2014 is about 22,000 pieces (J. Mendiola, M. Selch, per. com. September 2015). The farm gate value for that production is about US$66,000. FSM export records from CITES for the latest year available (2013) show that 3,314 pieces of live coral were exported.

Giant clam culture is being carried out in both Pohnpei and Kosrae. According to the two producers, a crude estimate of the annual production in 2014 is about 12,000 pieces. (J. Mendiola, M. Selch, per. com. September 2015). The farm gate value for that production is about US$60,000. FSM export records from CITES for the latest year available (2013) show that 11,321 pieces of live giant clams were exported.

Following from the above information on coral and giant clam culture, in terms of regional production there may be some double-counting involved. The traders in FSM buy some cultured corals from Palau and some giant clams from Kiribati (and subsequently export them), and export some giant clams to Marshall Islands (from where they are subsequently exported).

The pearl oyster (*Pinctada margaritifera*) has been cultured since 1994 on the remote atoll of Nukuoro. The farm is community-based (owned and operated by the municipal council) and has received funding and technical support since its inception. The farm relies on the collection of wild spat to supply the farm (Lindsay 2002). According to a Pohnpei State fisheries officer with involvement in the Nukuoro farm, about 1,600 pearls were actually sold in 2014 (I. Fred, per. com. September 2015). In addition, pearl shells are sold – possibly 8 mt per year. The farm gate value of that pearl and shell production is about US$34,000.

Sponges are cultured in Pohnpei. Annual production is about 1,800 sponges per year. (J. Mendiola, per. com. September 2015). The farm gate price of that production is estimated to be US$4,800.

Sandfish and seaweed culture is currently at a very small scale in FSM, and the amounts harvested in 2014 were not significant.

Table 7-5 summarises the 2014 aquaculture production of FSM.

Table 7-5: The 2014 Aquaculture Production of FSM

	Volume (pcs, and mt where indicated)	**Farm gate value** (US$)
Corals	22,000	66,000
Giant clams	12,000	60,000
Pearls and pearl shells	1,600 and 8 mt	34,000
Sponges	1,800	4,800
Total	**37,400 pcs and 8 mt**	**164,800**

Summary of Harvests

A crude approximation of the annual volumes and values[2] of the fishery and aquaculture harvests in 2014 can be made, based on the above sections, (Table 7-6).

Table 7-6: Annual Fisheries and Aquaculture Harvest in the FSM, 2014

Harvest Sector	**Volume** (mt, and pcs where indicated)	**Value** (US$)
Coastal Commercial	1,725	5,000,000
Coastal Subsistence	3,555	8,800,000
Offshore Locally based	40,838	85,342,200
Offshore Foreign-based	124,481	228,148,080
Freshwater	1	8,000
Aquaculture (pcs)	37,400 pcs and 8 mt	164,800
Total	**37,400 pcs and 170,608 mt**	**327,463,080**

Figures 7-1 and 7-2 show the volumes and values of the 2014 FSM fisheries production. Aquaculture volume is not shown, due to the use of mixed units (pieces and mt).

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.

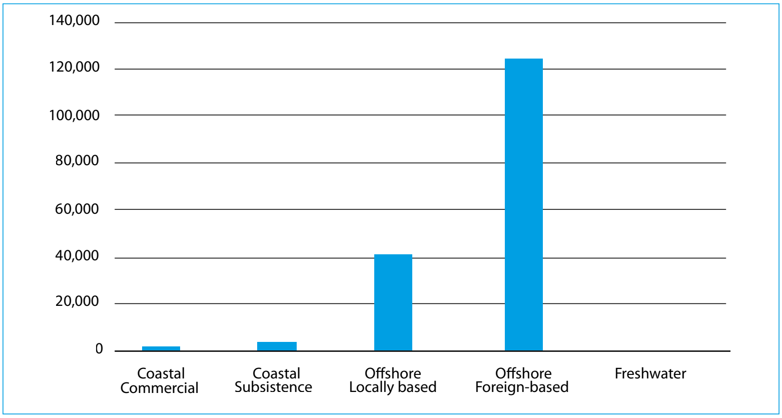


Figure 7-1: FSM Fisheries Production 2014 by Volume (mt)

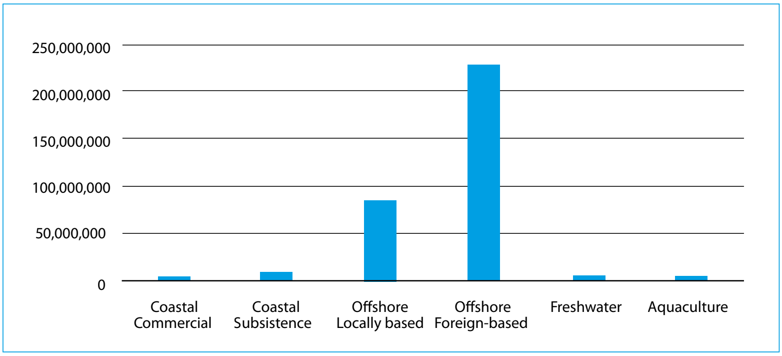


Figure 7-2: FSM Fisheries Production 2014 by Value (US$)

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The estimated fishery production levels for the FSM from those three studies are presented in Table 7-7[3].

3 The earliest Benefish Study, Gillett and Lightfoot (2001), did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 7-7: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, 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
Coastal Subsistence	1999	5,000	10,000,000
	2007	9,800	15,732,000
	2014	3,555	8,800,000
Offshore Locally based	1999	2,499	12,495,000
	2007	16,222	23,908,377
	2014	40,838	85,342,200
Offshore Foreign-based	1999	127,000	144,000,000
	2007	143,315	177,195,590
	2014	124,481	228,148,080
Freshwater	1999	n/a	n/a
	2007	1	8,000
	2014	1	8,000
Aquaculture	1999	n/a	n/a
	2007	16,000 pcs	80,000
	2014	37,400 pcs and 8 mt	164,800

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the 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 most of that change is due to the way in which the production was estimated. 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 the offshore fisheries and aquaculture (based on the availability of better quality data) are likely to reflect real changes in the amounts being harvested.

7.2 Contribution of Fishing to GDP

Current Official Contribution

The FSM GDP estimates are contained in the FY 2014 Statistical Compendium (Graduate School 2015). The compendium was prepared by the Graduate School USA, Pacific Islands Training Initiative, Honolulu, Hawaii, in collaboration with the Office of Statistics, Budget and Economic Management, Overseas Development Assistance and Compact Management. It was prepared under a contract with the United States Department of the Interior, Office of Insular Affairs. Fisheries aspects of the GDP were obtained from the compendium and are presented in Table 7-8.

Table 7-8: Fisheries Contribution to GDP (US$ millions)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Fisheries contribution to GDP	28.4	30.7	37.2	46.5	37.3	31.8
GDP at purchasers prices	278.5	295.6	310.4	325.8	315.7	318.1
Fisheries as a % of GDP	10.2%	10.4%	12.0%	14.3%	11.8%	10.0%

Source: Graduate School (2015)

Method Used to Calculate GDP

The individuals in the Graduate School responsible for the national accounts have a considerable amount of national accounts expertise, as well as years of experience in Micronesia. For various reasons, described in Section 31-4, those individuals have decided to treat the fishing sector in FSM somewhat differently than, for example, the International Monetary Fund and what is described in Appendix 3 of this book (hence "fisheries" instead of "fishing" in Table 7-8, above). The major changes the Graduate School has made are excluding the value added from foreign-owned, locally based fishing vessels, but including all fish processing and the shore-based services of the companies operating the foreign-owned, locally based fishing vessels. According to the individual compiling the GDP calculations at the Statistics Division (G. McKinlay, per. com. September 2015), the fisheries component includes the following:

- Shore-based services for fishing vessels
- Caroline and Diving Seagull fishing companies

- 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

Table 7-9, below, represents an alternative to the official method of estimating fishing contribution to GDP in FSM. 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 7.1, above (summarised in table 7-6), 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).

Table 7-9: Fishing Contribution to GDP in 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production (US$)	VAR	Value Added (US$)
Coastal Commercial	5,000,000	0.75	3,750,000
Coastal Subsistence	8,800,000	0.85	7,480,000
Offshore Locally based			0
Longline	22,518,450	0.2	4,503,690
Purse seine	62,823,750	0.5	31,411,875
Freshwater	8,000	0.95	7,600.00
Aquaculture	164,800	0.55	90,640.00
Total (US$)	**85,515,000**	--	**47,243,805**

Source: Above sections, and VARs from Appendix 3

The total contribution from fishing in calendar year 2014 in the table above (US$47.2 million) is 14.9% of GDP of US$318.1 million in FY 2014.

The major difference between the above estimate and the official estimate of the 10% fisheries contribution given in the section above is obviously that the official estimate includes shore-based services and excludes the operations of some locally based industrial fishing vessels. There are advantages to both the methodology of the official estimate and that of the present study. The former is oriented towards obtaining a picture of the entire national economy, and the cyclical ups and downs of industrial tuna fishing may distort other important changes in the economy. The present study is fisheries-oriented and, as such, it is important for tracking the economic contribution of locally based fleets – something that most countries in the region (including FSM) have been promoting for many years. Also, it is important for comparison purposes that the present study uses a methodology consistent with Gillett (2009).

7.3 Exports of Fishery Production

Discussion with the staff of the FSM Statistics Division (M. Chigiyal, per. com. Sept 2015) yielded information that is important in understanding FSM export statistics. There is no existing requirement in FSM for exporters to complete an exports declaration form with the Customs Department. Therefore, the Statistics Division uses an estimated number from other data sources. Data sources for offshore fish exports are the National Oceanic Resource Management Authority, the National Fisheries Corporation and staff estimates.[4] Data sources for inshore fish exports are quarantine records and airlines freight records for Chuuk State. The Statistics Division policy for inclusion/exclusion in fish exports is that fish should be included in exports if the exporting company is considered part of the FSM economy. Accordingly, the Statistics Division has deemed that the catch of the locally based longliners is not considered an export of FSM. The 2013 and 2014 FSM exports of fishery products are given in Table 7-10.

Table 7-10: Volume and Value of Fishery Product Exports

	Volume 2013 (kg)	Value 2013 (US$)	Volume 2014 (kg)	Value 2014 (US$)
Purse seine tuna	14,105,931	21,501,445	18,797,325	18,211,276
Longline tuna	0	0	0	0
Reef fish	154,038	1,302,160	124,103	1,040,484
Crab/lobsters	6,230	35,657	12,029	248,176
Trochus shell	0	0	0	0
Live clams	4,003	173,744	196	853
Other marine products	8,033	124,253	3,734	99,401
Total	**14,278,235**	**23,137,259**	**18,937,387**	**19,600,190**

Source: Statistics Division (unpublished data)

4 One of the most experienced offshore fisheries specialists in Micronesia joined the Statistics Division in 2007.

It is likely that some of the export categories in the table are under-estimated. Careful monitoring of reef fish exports by a University of Guam researcher during 2014 indicated that almost 200 mt of reef fish were exported from Chuuk to Guam alone. In the aquaculture section above it is estimated that about 12,000 giant clams were exported in 2014.

In the table above the nominal value of all exports of fishery products in 2014 (US$19.6 million) can be compared to the total exports of the country. Graduate School (2015) gives the total exports of FSM in 2014 as US$39.9 million, but of this US$13.0 million was for "Re-exports: fuel", so the real exports of the country could be considered to be US$26.6 million. Fishery products therefore represented 73.7% of the country's exports in 2014.

7.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

According to Phillip et al. (2015), the licensed foreign fishing in the FSM zone consisted of 83 longliners, 20 pole-and-line vessels, and 143 purse seiners. Those vessels were flagged in 12 different countries. Table 7-11 shows the access fees by category of vessel by calendar year.

Table 7-11: FSM Access Fees (US$)

Year	Longline	Pole and Line	Purse Seine	Support vessel	Total
2012	1,517,200	715,842	27,123,287	80,700	29,437,029
2013	793,625	612,110	29,731,302	71,400	31,208,437

Source: NORMA (unpublished data)

More up-to-date data is available from the FSM Statistics Division, but it is presented in a different form. Table 7-12 shows the fees actually collected (from government audits) by fiscal year (1 October - 30 September).

Table 7-12: Access Fees Collected (US$ millions)

Fiscal Year	Fees collected (cash)	Fees (in kind)	Total
FY 2008	17.045	0.257	**17.303**
FY 2009	20.016	0.288	**20.304**
FY 2010	17.727	0.308	**18.035**
FY 2011	18.811	0.317	**19.128**
FY 2012	26.384	0.354	**26.738**
FY 2013	35.050	0.275	**35.325**
FY 2014	47.518	0.219	**47.737**

Source: Graduate School (2011)

The fee information in the table can be compared to total government revenue.[5] Table 7-13 shows that access fees as a proportion of government revenue have steadily increased in recent years.

Table 7-13: Access Fees as a Percentage of Government Revenue

	FY 2010	FY2011	FY 2012	FY 2013	FY2014
Access fees cash US$ millions (from above table)	17.727	18.811	26.384	35.050	47.518
Government revenue US$ millions (from Graduate School [2015])	201.488	202.833	217.766	200.905	227.111
Access fees as a % of government revenue	8.8%	9.3%	12.1%	17.4%	20.9%

Other Government Revenue from Fisheries

The NORMA annual reports do not provide information on government revenue, other than fishing access fees. In FSM much of the non-access government revenue from the fisheries sector is acquired at the state level.

For example, OFA (2015) gives the revenue that the Pohnpei State government received from the fisheries sector in FY 2014. This includes the following:

- Water bunkering: US$179,126 (mostly for fishing vessels)
- Transshipment: US$117,721 (for the period March – September 2013)
- Commission on ice sales: US$197

7.5 Fisheries-Related Employment

The FSM Statistics Division collects employment information from the Social Security Administration and government payrolls. Table 7-14 from Graduate School (2015) shows the nominal and relative employment in the fishing industry. This could be considered equivalent to the number of formally employed wage earners in the fishing industry, and would not include self-employment or work for a small fishing business unless taxes and social security are paid.

Table 7-14: Employment in the Fishing Industry

	FY2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Number of people employed in fishing industry	261	327	294	247	269	250
Total employment in FSM	15,969	16,063	15,733	14,956	14,950	15,537
Fishing as a % of total employment	1.7%	2.1%	1.9%	1.6%	1.8%	1.7%

Source: Graduate School (2015)

5 Includes tax revenue, grants and other revenue.

The 2013/2014 household income and expenditure survey (Statistics Division 2014) contains some Fisheries-related employment information, as follows:

- 1.8% of total wage and salary income comes from fishing
- 12.9% of households are involved with subsistence fishing
- The net monthly value from subsistence fishing is US$18 per household

The Forum Fisheries Agency has a programme – Economic Indicators Project – that collects information on tuna-related employment in standard form. Table 7-15 shows FSM's tuna-related employment in recent years.

Table 7-15: FSM Tuna-Related Employment

	2010	2011	2012	2013	2014
Employment in tuna processing and ancillary	183	151	97	65	66
Local crew on tuna vessels	47	44	49	--	49
Total	**230**	**195**	**146**	**--**	**115**

Source: FFA (2014)

Quantifying gender participation in fisheries appears to have received limited attention in FSM. In 2000 and 2001, at the request of the FSM government, baseline surveys were conducted in Yap, Pohnpei, Chuuk and Kosrae, assessing the role of women in the fisheries sector, opportunities and constraints to their development, and areas for assistance (Lambeth and Abraham 2001). Although some valuable ideas were put forward in that study, little quantitative information was produced on the participation of women in fisheries.

In SPC's ProcFish Programme four locations were studied in FSM: two in Yap State and two in Chuuk State. SPC (2013) states that in Yap 20% of fishers were women and in Chuuk 32% were women.

7.6 Levels of Fishery Resource Consumption

Gillett (2009) examined past estimates of fish consumption in FSM. The various studies gave annual per capita consumption in the range of 72 kg to 114 kg per person per year. The Gillett (2009) study estimated 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. (2009) uses information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries and territories. The HIES 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 the per capita consumption of fish was 76.8 kg, and for urban areas it was 67.3 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.

The present study estimated, for 2014, a coastal subsistence fishery production of 3,337 mt and a non-exported coastal commercial fisheries production of 1,693 mt. The total non-exported coastal production was therefore 5,030 mt. With an FSM population of 102,908, that equates to an annual per capita consumption of domestic coastal fishery products of 49.9 kg. Kronen et al. (2009) indicate that the average annual per capita consumption of fresh fish at the four sites in SPC's ProcFish Programme (two in Yap State and two in Chuuk State) was about 63 kg.

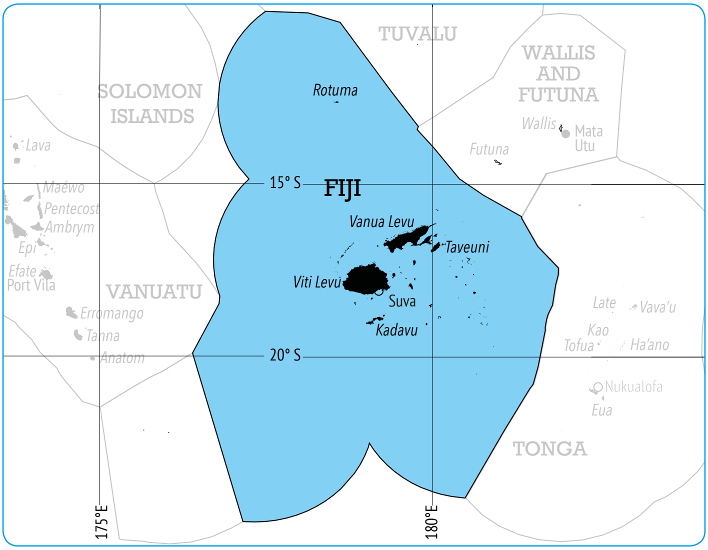
Rhodes et al. (2015) provide information on fish consumption on Pohnpei, expressed as edible amounts (i.e. food actually consumed, as opposed to whole weight equivalent in the above studies). They estimated that the annual per capita consumption of reef fish, pelagic fish and non-fresh fish on Pohnpei ranged 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.

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. There have apparently been no recent nutrition surveys in FSM providing information on fish consumption (A. Lawrence, per. com. August 2015).

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

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 between June and October 1993 (Rawlinson et al. 1993). The study estimated that the total catch made by subsistence fishers from rural Viti Levu to be 3,515 mt, and the artisanal catch to be 6,206 mt.
- Dalzell et al. (1996) estimated a coastal fisheries production of 23,252 mt, made up of commercial production of 6,653 mt (worth US$18,340,043) and subsistence production of 16,600 mt (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 the domestic markets in 2004 was 10,969 mt, 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 to be due to an enhanced data collection system.
- The draft Fisheries Department Annual Report 2006 (DoF 2015) (DoF 2008) gives information on the "artisanal catch" in 2005 and 2006. An approximate production of 5,994 mt 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 mt of finfish, at a value of F$28.6 million, and of non-finfish, valued at F$18 million, was recorded in 2006.

Of the more recent studies estimating coastal fisheries production in Fiji, Gillett (2009) considered several past estimates (including those by the Fisheries Department and Rawlinson), and included all relevant marine fisheries (including coral and other export fisheries), but excluded freshwater subsistence 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 mt, worth F$108,100,000, made up of a coastal commercial catch of 9,500 mt (worth F$54,000,000 to fishers) and a coastal subsistence catch of 17,400 mt (worth F$54,100,000 to fishers).

A study was carried out just after the Gillett (2009) study by researchers from the University of British Columbia. Starkhouse (2009) considered the Gillett (2009) study, but was confined to only coral reef species and non-exported products – which is quite different from the "coastal commercial" and "coastal subsistence" of the Gillett (2009) study. Starkhouse stated the total annual catch volume of reef-associated finfish by artisanal fishing was about 6,401 mt, while reef-associated invertebrates and marine plants contribute an additional 1,342 mt. 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 mt (± 2,373 mt). The finfish portion of the catch was 8,893 mt (± 2,096 mt), while the invertebrate portion of the catch was 1,141 mt (± 578 mt). 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, during 2008–2009, 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 (2009) and Starkhouse (2009) surveys, 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 the artisanal and subsistence fisheries for reef associated species to be about 17,777 mt, 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 considered to be associated with coral reefs. The report concluded that, considering these exclusions, the Starkhouse survey results and those of the Gillett (2009) study are not very different. (Gillett et al. 2014).

An IUCN study[1] that has considerable relevance to valuing coastal fisheries in Fiji was recently carried out under the MACBIO Programme (the Marine and Coastal Biodiversity in Pacific Island Countries [MACBIO] project). That work focused on the economic evaluation of marine and coastal ecosystem services in Fiji. The ecosystem services analysed were 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 the subsistence fishery in Fiji in 2014 was estimated to be 15,385 mt, 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 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 data (for the subsistence estimate) and to the Fisheries Department's market surveys (for the small-scale commercial component). There is a general emerging sentiment among fisheries

1 Gonzalez R., V. Ram-Bidesi, N. Pascal, L. Brander, L. Fernande, J. Salcone, and A. Seidl. 2015. Economic Assessment and Valuation of Marine Ecosystem Services: Fiji: A Report to the MACBIO project. GIZ/IUCN/SPREP, Suva.

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.

In the period since the Gillett (2009) and Starkhouse (2009) studies there have been a number of events and changes in Fiji that could affect coastal fisheries production, which include the following:

- The Fiji population has increased by 3.1% in the period 2007 to 2014 (SPC PRISM website data). There has also been increasing urbanisation.
- The focus of the Fisheries Department has continued to be on increasing fisheries production, rather than on measures to ensure the continuation of that production.
- The Fisheries Department has established additional rural fisheries service centres and has acquired a vessel to purchase fish from the outer islands. Both of these actions tend to facilitate the flow of commercial fish to urban centres.
- Several recent studies (summarised in Gillett et al. [2014]) point to the fully or over-exploited nature of many of the important fishery resources in the country.
- NGOs have been increasingly active in community-level marine conservation efforts.
- The exports of almost all categories of coastal fisheries products have increased in the period 2007–2013 (DoF 2014).
- The net change in prices for domestically consumed coastal fishery products over the period 2007–2014 has been relatively small, according to information from the Fiji Bureau of Statistics consumer price index.

Selectively applying the above information, it is estimated that coastal fisheries production in Fiji in 2014 was 27,000 mt, worth F$133 million, made up of a coastal commercial catch of 11,000 mt (worth F$75 million to fishers) and a coastal subsistence catch of 16,000 mt (worth F$58 million to fishers).

Coastal Subsistence Catches

For several decades annual estimates of coastal subsistence fisheries catches appeared in Fisheries Department annual reports. The last estimate by the department appeared in the 2007 Annual Report (DoF 2008), when an estimate of 19,000 mt from 2004 was quoted. The 2004 Annual Report (DoF 2005) gives subsistence fishery harvests, as follows: 2000 – 18,000 mt; 2001 – 18,200 mt; 2002 – 18,400 mt; 2003 – 18,600 mt; 2004 – 18,800 mt. The 2014 Annual Report (Fisheries Department 2015) does not contain the word “subsistence”.

It is important to provide some background on the older estimates of subsistence production by the Fisheries Department. The subsistence estimates 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 mt of fish to the unreliable 1979 figure. 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 mt, 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 mt each year, given recent temporal and spatial population growth patterns. (B. Starkhouse, per. com. August 2008).

Following the approach taken in the above section on coastal commercial fishing, it is estimated that, in 2014, Fiji’s coastal subsistence catch was 16,000 mt, worth F$58 million to fishers.

Locally Based Offshore Catches

According to Fiji’s Annual Scientific Report to the Western and Central Pacific Fisheries Commission (OFD 2015), in 2014 the national fleet consisted of 105 Fiji national vessels, of which 10 vessels were chartered foreign flagged vessels. The remaining 95 vessels were Fiji-flagged, and fished in Fiji's EEZ, other EEZs and on the high seas within the WCPO. The Fiji national fleet is categorised as follows:

- Less than 21 m category – there are 11 vessels in this category, and the vessels mainly use ice for preserving the catch, which is targeted for the fresh sashimi market. These vessels predominantly fish within Fiji's archipelagic waters and territorial seas, spending one to two weeks on each trip.
- 21 m and less than 30 m category – there are 47 vessels in this category, and they use ice slurry and freezers to preserve the catch. These vessels mainly fish within Fiji's EEZ, and spend three weeks to two months per fishing trip. Fresh catch is usually caught towards the end of the fishing trip to maintain its standard for the market preference.
- Greater than 30 m category – there are 47 vessels in this category, and they use freezers to preserve their catch. These vessels mainly fish within Fiji's EEZ and outside Fiji's national jurisdiction, targeting albacore. They spend more than three months on each trip.

McCoy et al. (2015) contains some information about recent changes in the Fiji-based longline fleet. A decline in albacore catch rates that began around 2009 has coincided with an increase in fishing effort that began in 2008. Although the albacore resource does not appear threatened (i.e. stocks are not in an overfished state, and over-fishing is not occurring), the decline in catch rates has resulted in some major economic problems for Fiji's domestic longline fleet. Many Fiji-flagged longline vessels are old, with some initially intended for other fisheries, such as pole-and-line. The vessels are often not able to compete with newer, subsidised vessels from China that have entered the fishery. Consequently, over the past two to three years two companies have ceased longlining, and their assets were acquired by other companies.

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries Commission have been made by the Forum Fisheries Agency using data sourced from the Pacific Community's Oceanic Fisheries Programme. The volumes and values can be determined using the "catch by national fleet" and "value by national fleet" spreadsheets of FFA (2015). The volumes/values in Table 8-1 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 are therefore equivalent to Fiji dockside prices (prices paid to fishers).

Table 8-1: Volumes and Values of the Catch of Fiji's Longline Fleet

	2010	2011	2012	2013	2014
Catch volume adjusted for by catch (mt)	15,681	20,384	18,722	15,978	17,079
Catch value adjusted for bycatch sales and transport costs (US$)	41,530,512	67,336,835	63,441,007	40,571,732	54,364,955

Source: FFA (2015)

From the above table it can been seen that, in 2014, the production from Fiji's longline fleet was 17,079 mt, worth US$54,364,995 (F$107,642,610) to fishers.

Foreign-Based Offshore Catches

FFA (2015) provides information on the catches by foreign-based offshore fishing in the Fiji zone. These are given in Table 8-2. The only foreign vessels that have been authorised to fish in the zone in the last few years have been US purse seiners under the US Multi-Lateral Treaty on Fisheries[2] (A. Raiwalui, per. com. August 2015).

Table 8-2: Value of the Catch by Foreign-Based Offshore Fishing in the Fiji Zone

	2010	2011	2012	2013	2014
Volume (mt)	1,189	452	531	162	0
Value of catch adjusted for transport (US$)	1,293,298	679,501	989,489	294,554	0

Freshwater Catches

Harvests of freshwater finfish and invertebrates in Fiji consist mainly of freshwater clams (*Batissa violacea*), eels, 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)

2 Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America

- The Fisheries Department Annual Report 2004 (DoF 2005) provides the amounts of various fishery products sold in municipal and non-municipal markets in 2004. 2,526 mt of Batissa[3] were sold at the two types of markets, for a total price of about F$2.2 million. 500 mt of various species of freshwater crustaceans were sold, for a total price of about F$6 million.
- Richards (1994) reports that annual markets sales of Batissa ranged from 1,000 mt to 1,800 mt in the period 1986 to 1992.
- Fisheries Department staff indicated that the harvest of clams/crustaceans for non-market purposes is probably less than what is marketed.
- 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.
- Thaman (1990) indicates that flagtails (*Kulia spp.*) and a number of gobi species are important for interior villages, but that abundance has decreased in recent years.
- The numbers of fish species in Fijian rivers have been significantly affected by a loss of catchment forest cover and introductions of tilapia. On average, stream networks with have 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 "educated" guesswork. The estimate provided in the Gillett (2009) study was 4,146 mt, worth F$6,860,000. Decreasing that volume by 10% for degradation of freshwater systems, and increasing the value by 20% to account for price increases, results in an estimate of 3,731 mt, with a value to fishers of F$7,408,000.

Aquaculture Production

Aquaculture efforts in Fiji have included tilapia, carp, freshwater shrimp, penaeid shrimp, milkfish, seaweed, giant clams, trochus, pearl oysters, milkfish, beche de mer, sponges, turtles, mudcrab, and corals. The primary focus of the Fisheries Department in the last few years has been on tilapia, shrimp, seaweed and pearl oysters.

An attempt was made to estimate aquaculture production in Fiji for 2014. This was difficult due to a number of factors, including: (a) several cases of lack of production statistics; (b) other situations where one set of production statistics

3 This includes the shell weight. The raw meat recovery represents approximately 20% of the overall weight.

conflict with other production statistics and/or export statistics; and (c) commercial secrecy.

Pearl production in Fiji is especially difficult to estimate. The Fisheries Department has declared exports by the major producer for 2013 but not for 2014. Many pearls are sold domestically to tourists, and therefore do not appear in export declarations or trade statistics. In Fisheries Department records the declared FOB value for 2013 for the major producer was F$305,445, for 19.980 kg of pearls. FAO trade statistics for that year indicate only US$7,390 [sic] of Fiji pearl exports. The major producer indicated that his annual exports in recent years have ranged from F$1 million to F$2 million annually (J. Hunter, per. com. December 2015). In order to make even a crude estimate of pearl production in Fiji with the information available to the present study, a number of assumptions must be made, some of which may not reflect the real situation. It is possible to advance an estimate of pearl production in Fiji based on the following assumptions about the major producer: (a) it is actually exporting F$1 million to F$2 million of pearls per year, (b) it sends 90% of its production overseas, (c) it is responsible for 95% of the production of pearls in Fiji, (d) the farm gate value is 90% of the FOB value, and (e) the FOB value per kg (F$15,288; obtained from the 2013 declaration) is accurate.

With those assumptions, an estimate of the annual Fijian pearl production for recent years is about 103.2 kg, with a farm gate value of F$1,578,000. This value does not include post-harvest value-adding (i.e. manufacture of jewellery), which is probably substantial.

Another pearl-related aquaculture activity in Fiji is the production of oyster spat by communities for sale to the larger pearl oyster farms. A Fisheries Department official with responsibility for the pearl industry indicated that, in recent years, about 30 communities have been involved in the sale of spat. It is estimated that the average participating community sells an average of F$3,000 worth of spat per year (1,500 individual spat), representing a gross annual value across the 30 communities of about F$90,000 (45,000 spat). (G. Vuibeqa, per. com. November 2015)

The head of the Aquaculture Division of the Fisheries Department indicated a production of 145.6 mt of tilapia in 2013, and 150.5 mt in 2014 (S. Singh per. com. Nov 2015). The Fisheries Department Annual Report 2014 (DoF 2015) indicates 2014 tilapia production of 20.196 mt.

At a market price of F$5 per kg[4], the 2014 production (provided by the division head) equates to a farm gate value of F$526,750.

The head of the Aquaculture Division of the Fisheries Department indicated that the 2014 seaweed production was about 30 mt. At a farmer buying price of F$0.90 per kg, this equates to a farm gate value of F$27,000.

Both penaeid and freshwater shrimp are produced in Fiji. According to the Fisheries Department, 11.462 mt of freshwater shrimp and 5.617 mt of penaeid shrimp were produced in 2014. The farm gate value for that production is estimated to be F$140,425 for penaeid shrimp and F$183,392 for freshwater shrimp.

Cultured coral and cultured live rock (both for the aquarium trade) are also produced in Fiji. The sole producer of these products indicated that his 2014 production was 2,706 pieces of cultured coral and 37,530 pieces of cultured live rock (W. Smith, per. com. December 2015). Using the producer's price list, the farm gate value of the production of both coral and rock is estimated to be F$150,000.

Mud crab (*Scylla serrata*) is cultured by one company in Fiji. It was not possible to obtain information from the company. The 2014 production is estimated to be about 7 mt, with a farm gate value of about F$180,000.

The above information is summarised in Table 8-3.

Table 8-3: Summary of Fiji Aquaculture Production in 2014

Commodity	**2014 production volume** (kg or pieces)	**2014 Production values** (F$)
Tilapia	150,500	526,750
Freshwater shrimp	11,462	183,392
Penaeid shrimp	5,617	140,425
Pearls	103.2	1,578,000
Pearl oyster spat	45,000 pieces	90,000
Seaweed	30,000	27,000
Cultured coral	2,706 pieces	150,000
Cultured rock	37,530 pieces	
Mud crab	7,000	180,000
Total	**204,682.2 kg plus 85,236 pieces**	**F$2,875,567**

4 Tilapia at Nausori market on December 15, 2015 sold for F$5/kg. The farm gate price is estimated to be F$3.50/kg.

Summary of Harvests

Using the above information, a rough approximation of annual volumes and values[5] of the Fiji harvest in 2014 can be made (Table 8-4).

Table 8-4: Annual Fisheries and Aquaculture Harvest in Fiji, 2014

Harvest Sector	Volume (mt, and pcs where indicated)	Value (F$)
Coastal Commercial	11,000	75,000,000
Coastal Subsistence	16,000	58,000,000
Offshore Locally based	17,079	107,642,610
Offshore Foreign-based	0	0
Freshwater	3,731	7,408,000
Aquaculture	204,682.2 mt and 85,236 pieces	2,875,567
Total	**252,456 mt and 85,236 pieces**	**F$ 250,926,177**

The extremely weak factual basis for the estimates of the coastal and freshwater catches are acknowledged.

Figures 8-1 and 8-2 show the volumes and values of the 2014 Fiji fisheries production. Aquaculture is not shown on the volumes figure, due to the use of mixed units (pieces and mt).

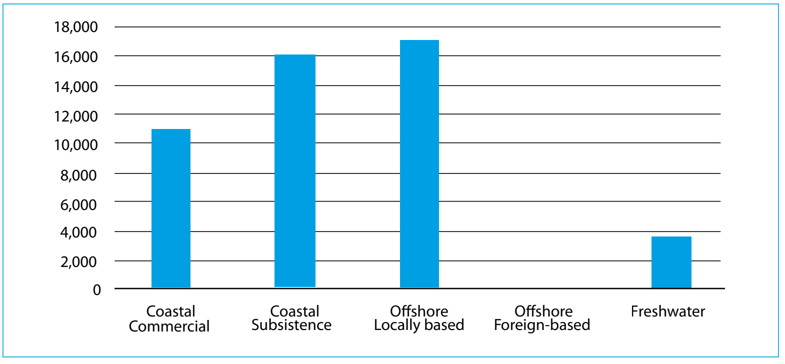


Figure 8-1: Fiji Fisheries Production 2014 by Volume (mt)

5 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.

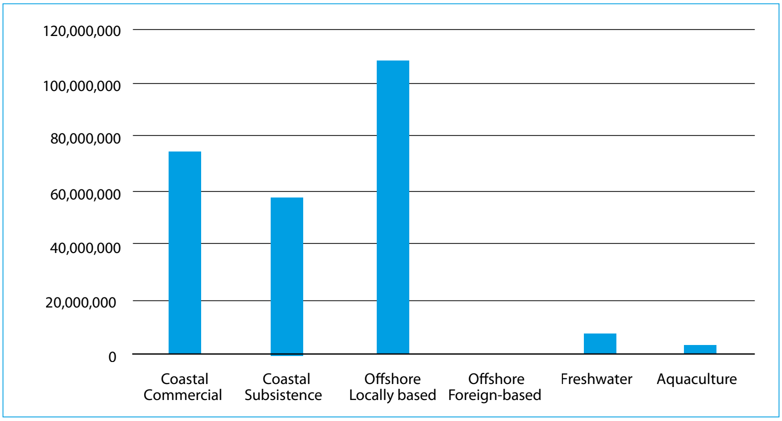


Figure 8-2: Fiji Islands Fisheries Production 2014 by Value (US$)

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007 and the present study focuses on 2014. The estimated fishery production levels for Fiji from those three studies are presented in Table 8-4.[6]

6 The earliest Benefish Study, Gillett and Lightfoot (2001), did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 8-5: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvests Sector	Estimate Year	Volume (mt, 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
Coastal Subsistence	1999	21,600	48,600,000
	2007	16,000	58,000,000
	2014	17,400	54,100,000
Offshore Locally based	1999	5,500	50,500,000
	2007	13,744	46,870,000
	2014	17,079	107,642,610
Offshore Foreign-based	1999	917	1,093,000
	2007	492	844,000
	2014	0	0
Freshwater	1999	n/a	n/a
	2007	3,731	7,408,000
	2014	4,14	6,860,000
Aquaculture	1999	n/a	n/a
	2007	85,236 pcs and 204,682.2 mt	2,875,567
	2014	48,100 pcs and 247 mt	2,799,000

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the 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 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. In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better quality data) are likely to reflect real changes in the amounts 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: The Official Contribution of Fishing and Aquaculture to GDP (F$ millions)

	2011	2012	2013	2014p
Fishing & Aquaculture	118.7	122.6	124.9	130.2
Subsistence	37.0	38.7	41.5	45.3
Informal	6.3	6.7	7.1	7.8
General Government	1.6	1.9	2.3	3.2
Non-General Government	73.8	75.3	74.0	74.0
Fiji GDP	5,738.8	6,010.1	6,440.0	7,129.8
Fishing & Aquaculture as % of GDP	2.07%	2.04%	1.94%	1.83%

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

From comment in various reports, there appears to be some confusion, or at least uncertainty, about the actual contribution of fishing and aquaculture to Fiji's GDP, including the following:

- An IUCN report (Verdone and Seidl 2012) misquotes an ADB report in stating: "Artisanal and offshore-commercial fishing activities accounted for 3.16% of Fiji's GDP in 2009 and while it is not officially recorded as GDP, some estimates suggest that subsistence fishing activities produce as much as 4% of Fiji's annual GDP."
- The Fisheries Key Statistics Report 2013 (Fisheries Department 2014) states: "The fisheries sector accounts for an average of 2.7% of GDP for the past 10 years."
- The Fisheries Department Annual Report 2014 (DoF 2015) states: "Fisheries sector contributes around 2.8 percent to GDP."
- The Fiji Times, 15December 2015 states that the contribution of the fishing and aquaculture industries was F$118.8 million for 2014.

Method Used to Calculate the Official Fishing Contribution to GDP

Staff of the Fiji Bureau of Statistics (B. Krisha, per. com. November 2015) explained some aspects of calculating the fishing contribution to Fiji's GDP:

- The subsistence and informal sectors are from the 2007 HIES, adjusted for population and the price of fish.
- The "non-general government" is actually "general non-government"; that is, the private sector. Gross value of production is from the Fisheries Department. The intermediate consumption is determined by surveys of fishing companies.
- The "general government" category is for wages of government employees that provide services that are closely related to fisheries production (i.e. those that increase productivity).

On the final point, the method used by most countries in the world to calculate GDP is generally based on a standardised System of National Accounts (SNA) that is described in Appendices 2 and 3 of this book. According to that system, the wages paid to government employees for advisory services are not a part of the fishing sector, and therefore the F$3.2 million contribution to GDP of the "general government" category given in the table above is inconsistent with SNA. Although the Fiji government (through its Bureau of Statistics) can construct the national accounts as it sees fit, the way Fiji's fishing sector is currently constructed is inconsistent with international procedures, and inter-country comparisons are therefore difficult.

A Fiji Bureau of Statistics publication titled "A Study of the Agriculture, Forestry and Fishing Industries 2012" (FBS 2012) contains some information on the fishing-related GDP methodology. Because the sub-classes of the fishing sector given in that report are quite different from the sub-classes in the table above (e.g. "Bech-de-mer diving", "Taking of marine crustaceans and molluscs"), it is assumed that the report applies to a former methodology.

Alternative Estimate of Fishing Contribution to GDP

Table 8-7, 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 8-7 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 8-7: Fishing Contribution to GDP in 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production (F$, from Table 8-4)	VAR	Value Added (F$)
Coastal Commercial	75,000,000	.55	41,250,000
Coastal Subsistence	58,000,000	.80	46,400,000
Offshore Locally based	107,642,610	.20	21,528,522
Freshwater	7,408,000	.90	6,667,200
Aquaculture			
Pearls & coral	1,728,000	.45	777,600
Other aquaculture	1,147,567	.73	837,724
Total	**250,926,177**	--	**117,461,046**

The total value added in Table 8-7 (F$117.5 million) is about 10% less than the official value added of F$130.2 million. In the Gillett (2009) study (which focused on the year 2007), the contribution of fishing in the alternative approach was about 12% less than the official approach. The following should be noted in comparing the official and alternative 2014 contributions:

- The contributions of subsistence fishing are similar in the two approaches.
- As mentioned above, the alternative approach does not include government advisory services. However, the amount in the official approach is relatively small (F$3.2 million).
- The significant difference appears to be in the "non-general government" category – which would appear to refer to formal private sector fishing. Without more detail on the official methodology it is not possible to specifically identify the source of the difference. One possibility was noted in the Gillett (2009) study: that the contribution from locally based offshore fishing appeared to be too large. It is stated above that: "The intermediate consumption for this category is determined by surveys of fishing companies." During the present study the reports of those surveys were not sighted.

8.3 Exports of Fishery Production

Unpublished data provided by SPC's Statistics for Development Division (N. Lal, per. com. August 2015) compares the fisheries products exports of Fiji with all exports (Table 8-8).

Table 8-8: Value of Fishery Product Exports (FJ$ thousands)

	2010	2011	2012 p	2013 p	2014 [p]
Fish of which:	204,227	102,919	57,817	84,415	108,659
Canned fish value (F$ thousands)	964	2,205	2,645	20,000	24,867
Canned fish volume (mt)	209	447	536	11,484	14,811
Fresh fish value (F$ thousands)	162,331	51,181	29,214	43,127	37,978
Coral and similar materials (F$ thousands)	3,480	3,828	4,254	5,156	5,703
Total domestic exports (F$ thousands)	1,062,931	1,023,676	1,045,129	976,490	1,230,566
Fish and coral as a % of total exports	**19.5%**	**10.4%**	**5.9%**	**9.2%**	**9.3%**

p = provisional
Source: SPC (unpublished data)

The composition of the category "fish" in the table is not clear, but presumably it is broader than just finfish. The "canned fish" volumes and values appear too large, as only about 20% of the Pacific Fishing Company (PAFCO) factory output is for canning, and most of its canned products are not exported – the category presumably includes loins (i.e. fish destined for canning overseas).

Additional information about Fiji's fishery exports can be obtained from a database maintained by the Fisheries Department that is compiled from compulsory coastal fishery export permits. Table 8-9 shows the 2014 exports, in either pieces or kg.

Table 8-9: Coastal Fishery Exports 2014

	Unit	Total
Aquarium products	Kg	1,169,303
	pcs	736,566
Beche de mer	Kg	132,127
	pcs	70
Fish steak (reef fish)	Kg	211
Gastropods	pcs	100
Invertebrate products	Kg	271
Ornamental products	Kg	600
	pcs	2,064,480
Other marine products	Kg	24,823,233
Reef fish	Kg	17,420
Shells	Kg	39,061
	pcs	2,005,676

Source: Fisheries Department (unpublished data)

Coastal fishery exports also appear in the Fisheries Department Annual Report. Because the exports are categorised differently from the above table, comparisons are difficult, except for beche de mer. The 2014 Annual Report (DoF 2015) indicates 2014 beche de mer exports were 90,138 kg.

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 Harmonized System (HS) Codes[7] 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 2014, F$251,476 of "Other fish excluding livers and roes" were exported. Using a variety of sources, an FFA report (McCoy et al. 2015) summarises the average annual tuna exports of Fiji over the period 2008–2013 (Table 8-10).

Table 8-10: Average Annual Volumes and Values of Fiji Tuna Exports

	Product Category	Volume (mt)	Value (US$)	Destinations by Value (percent)
USA MARKET	Whole round	1,506	5,875,203	USA (100)
	Fresh and frozen, value added	430	2,420,383	USA (100)
NON-USA MARKET	Fresh tuna	802	7,673,678	Japan (83) New Zealand (11 Australia (5) Others (1)
	Frozen tuna	6,430	19,503,833	Japan (59) Thailand (22) Korea (12) Others (7)

Source: McCoy at al. (2015)

7 HS is the international harmonised system of six-digit codes for international trade.

To understand the export from Fiji of tuna products, some knowledge of the tuna processors is required. Box 8-1 from McCoy et al. (2015) summarises the situation in early 2015.

Box 8-1: Tuna Processing in Fiji in 2015

The major government investment in the fisheries sector is in the Pacific Fishing Company (PAFCO), a loining and canning facility at 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. 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 is 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.

Viti Foods Ltd – a Fiji food processing subsidiary of the CJ Patel Group – cans tuna and mackerel for local sale and export. In 2014 it reportedly increased its investment in its plant by an undisclosed amount in order to increase production and meet global food safety compliance standards. The canning plant produces canned tuna and mackerel (the latter from imported raw material) under the Skipper (tuna) and Angel (mackerel) brands. The company reportedly also does some private label canning for local supermarket chains.

TriPacific Marine has invested in processing machinery, and upgraded its plant to produce pouched tuna and wahoo for the domestic and export market, in addition to other fresh/frozen products. The pouch tuna products are aimed at catering to markets in Australia and New Zealand, while wahoo is said to be produced in a smaller, 300 g, consumer size for domestic sale.

8.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

Since 2006 the only foreign-based vessels that have been licensed to fish in Fiji waters are those operating under the US Multi-Lateral Treaty on Fisheries (A. Raiwalui, per. com. August 2015). It is shown above that catches by the US fleet in the Fiji zone were 162 mt in 2013, while there were no catches in 2014.

According to FFA and US government unpublished data, the equal share that each Pacific Island party (including Fiji) received from the US treaty in 2014 was US$555,814.65 (F$1,100,513). As the total revenue of the Fiji government was F$2,380,735,000 in 2014 (Fiji Bureau of Statistics website), the 2014 access fee payment amounted to about 0.04% of total revenue for that year.

Other Government Revenue from Fisheries

Government revenue from fisheries is collected at both the national and the divisional/provincial levels. At the national level the locally based offshore fleet is required to pay a number of government charges. The Fiji Tuna Management and Development Plan (2012–2016) states: "It is a requirement that all Fiji registered and licensed fishing companies and fishing vessels pay to government fees in accordance to conditions and terms of licenses and permits, and consistent with fixed fees structure. These fees include licensing fees, fishing fees, port charges, export permits and taxes." In practice, the major fees for the locally based offshore fleet are the access fee, the management fee and the observer levy. According to Fisheries Department unpublished data (J. Amoe, per.com. December 2015), those fees amounted to F$$844,000 in 2013 and F$701,000 in 2014.

Also, at the national level, the Fisheries Department charges for a variety of permits. In the Fisheries Department Annual Report 2014 (DoF 2015) the number of permits (but not the revenue generated) is given (Table 8-11).

Table 8-11: Permits Issued 2014

Type of permit	Number issued in 2014
Landing permit	1,287
Transshipment	319
Export	393
High seas	67
Bycatch	205
Import	187
CITES	514
Total	**2,972**

Source: Fisheries Department Annual Report 2014

Fiji is divided into four divisions for government administrative purposes: Northern, Eastern, Western and Central. Certain types of government fees are charged at the divisional and provincial levels. For example, the fees of the Northern Division are given in Table 8-12.

Table 8-12: Sources of Government Revenue in the Northern Division

Source of Revenue	Province of the Northern Division		
	Macuata	Bua	Cakaudrove
Sale of Ice	87,421.18	24,101.55	13,870.32
Inshore Fishing Licence Fees	4,843.40	1,152.90	3,245.45
Vessel Registration Fees	2,952.40	408.70	488.40
Crew Registration Fees	2,907.00	606.05	359.04
Confiscated Species	2,905.20	207.27	0
Slipway Fees	27.60	0	0
Total	**101,056.78**	**26,476.47**	**17,963.21**

Source: Fisheries Department Annual Report 2014

8.5 Fisheries-Related Employment

The Fiji Employment/Unemployment Survey 2010–11 contains some detailed information, but unfortunately the results relevant to fisheries are lumped with some other sectors. For example, the "estimated numbers of wage and salary earners" is only given for the combined category of "Agriculture, Forestry & Fishing". Similarly, The 2004–2005 Employment and Unemployment Survey provides limited insight into fisheries-related employment, due to aggregating all agriculture, forestry and fisheries occupations. It does, however, give the number of people in Fiji that are either wage/salary earners or self-employed, as 150,982 (38% female), and 91,818

(25% female), respectively. These more specialised studies are useful for gauging the relative importance of fisheries-related employment in Fiji.

Gillett et al. (2014) attempted to quantify employment in coastal fisheries in the Fiji, and to compare it to employment in offshore fisheries. The report stated:

> Starkhouse (2009) appears to be the most methodical study of employment in Fiji's coastal fisheries. 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 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, 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 23 times the number employed in offshore fishing and 1.5% of the total population.

The Forum Fisheries Agency has a programme – Economic Indicators Project – that collects data on tuna-related employment in standardised form. FFA (2015) contains information on the employment of people from Fiji in the tuna industry (Table 8-13). A total of 3,667 Fijians were employed in the tuna industry in 2014. Across the Pacific, in 2014, 17,663 people were employed as crew on tuna vessels or in tuna processing and ancillary work. Tuna-related employment in Fiji therefore represents 20.8% of the regional tuna-related employment.

Table 8-13: Tuna-Related Employment in Fiji (number of people employed)

	2009	2010	2011	2012	2013	2014
Processing and ancillary	1,054	630	1,018	1,063	1,452	2,000
Local crew	1,290	228	353	531	1,227	1,667
Total	**2,344**	**858**	**1,371**	**1,594**	**2,679**	**3,667**

Source: FFA (2015)

McCoy et al. (2015) contains some additional information on tuna-related employment in Fiji:

> The major purpose of government investment in PAFCO is to provide employment in an area of Fiji where there are few jobs. PAFCO remains the single largest fish processing employer with about 900 employees. In 2009 the wages and salaries paid by fish processors in Fiji was estimated at F$8.9 million, with PAFCO's share at F$5.4 million. Available jobs at processing facilities at PAFCO and in Suva can vary somewhat on a seasonal basis. PAFCO can add around 100 jobs during peak periods and TriPacific in Suva can seasonally increase their full time staff from 70 to 120 or more. It is unlikely that future opportunities for crew will grow significantly, as the number of licensed vessels has been capped and many Fiji-based vessels are manned by Chinese or other foreigners. It is worth noting that although total annual numbers of Fijians employed onboard tend to be erratic, over time Fijians have obtained competency to a point where many domestic vessels have Fijians working as captains, engineers, and deck bosses.

Sullivan and Ram-Bidesi (2008) is a study of women in the tuna industries of Fiji, Kiribati and Papua New Guinea. Table 8-14 summarises the results of that study.

Table 8-14: Employment of Women in the Tuna Industry

Indicator	Fiji	Kiribati	Papua New Guinea
Wage employment	Total females in tuna companies: PAFCO= 544 Longline = 110 + 173 Total = 827	CCPL = 4 (in processing)	About 7,000 women work in the PNG tuna industry, including onshore handling, loining/canning, technical and administrative positions.
Indication of importance of above wage employment	37,438 female wage jobs in 2007. Tuna-related wage jobs therefore represent 2.2% of the total female wage jobs in Fiji.	With a total of 7,467 women in cash employment in Kiribati in 2005, the above 4 jobs are relatively insignificant	The 2000 census states that 211,443 women were formally employed. The tuna industry therefore employs 3.3% of all formally employed women.
Annual wages for women formally employed	PAFCO = F$2,397,606 to F$3,557,409	About AU$16,000	Loining/canning: RD = US$1,875,000 SST = US$360,000 Frabelle= US$450,000
No. of women marketing tuna (informal sector)	Unknown	About 189 women are involved full time in the sale of tuna in South Tarawa.	Unknown
Indication of importance of above informal employment	Unknown	Income from artisanal tuna sales represents about 1.3% of all income in South Tarawa.	Unknown

The findings of the study with respect to constraints and available opportunities for women in Fiji are:

- PAFCO is the largest national employer of women in the tuna industry, and is in a unique position as a publicly subsidised private enterprise. Given its central position in the Ovalau economy, important initiatives are needed to increase local participation in general, and to promote transparency in management-staff and management-community relations.
- For the longline fishery, women could progress faster in the companies if they were provided with relevant training, especially those that have demonstrated promise.
- The industry requires more assistance to support product development and secondary processing skills, and to provide opportunities to attract more women into emerging, value-added tuna cottage industries linked to the longline fishery.

Compared to the tuna-related employment described above, there is less information on participation in village-level fisheries in Fiji. As mentioned above, Starkhouse (2009) estimates there are approximately 23,000 subsistence fishers in Fiji.

The SPC ProcFish programme carried out survey work at Dromuna, Muaivuso, Mali and Lakeba (Friedman et al. 2010). That work included estimates of participation by households in reef fisheries. The results show very high participation in fisheries activities in the four villages (Table 8-15).

Table 8-15: Participation of Households in Reef Fisheries

Village	% of Households
Dromuna	100
Muaivuso	100
Mali	93.8
Lakeba	100
Average across the four sites	98.5

Source: Friedman et al. (2010)

SPC (2013) uses ProcFish data to examine the ratio of men to women fishers across the Pacific. For the Fiji sites examined, about 54% of fishers are men (46% women).

8.6 Levels of Fishery Resource Consumption

The following summarise some of the results of some 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 the subsistence fishery provided 46%.
- Preston (2000), using 1995 FAO production, import and export information, indicated the apparent per capita supply of fish in Fiji was 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, rather than 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% eating canned fish on a daily basis.

Bell et al. (2009) used information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES 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 ProcFish programme 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 8-16) indicate very high consumption of fresh fish at the four sites.

Table 8-16: Fishery Product Consumption at ProcFish Sites (kg/person/year)

Village	Fresh fish consumption	Invertebrate consumption	Canned fish consumption
Dromuna	74	4.4	2.9
Muaivuso	68	10	3
Mali	81	13.1	1.8
Lakeba	73	10.5	1.8
Average across the 4 sites	74.0	9.5	2.4

Source: Friedman et al. (2010)

In recent years, the total annual catch from locally based offshore fishing was about 17,000 mt (Section 7.1). About 12.5% of the production from Fiji's locally based offshore fisheries is not exported, but rather is marketed domestically in the greater Suva area (G. Southwick, per. com. August 2015). The population of the greater Suva area is about 180,000. This suggests an annual supply of fish to Suva residents from the local offshore fleet of 11.8 kg per capita.

8.7 Exchange Rates

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

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.73	1.70	1.73	1.60	1.51	1.92	1.81	1.84	1.79	1.88	1.98

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), using data from a 1991 nutritional survey, estimated coastal commercial fisheries production of 3,240 mt (worth US$4.8 million) and subsistence fisheries production of 9,084 mt (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 mt (worth US$9.8 million), and subsistence fisheries production of 10,000 mt (worth US$12.2 million).

- Recent 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. That report 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) partitions coastal fisheries production into two components: household fishery catch and export fishery catch. An annual household fishery catch of 20,000 mt 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 (2009): (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 (2009) estimated that, in the mid-2000s, coastal commercial production was about 7,400 mt (worth about A$22 million [Australian dollars] to fishers), and subsistence production was about 13,700 mt (worth about A$34 million to fishers).

As much of the information used in making the above estimates of coastal fisheries production is still relevant today, some of the important older studies and data are presented in the following paragraphs. This is followed by commentary on a recent study, some recent developments affecting coastal fisheries production, and, finally, an updated estimated of coastal fisheries production.

A household income and expenditure survey was carried out in Kiribati in 2006. Unpublished data on this HIES, kindly supplied by SPC's Statistics and Demography Programme, shows that, in Kiribati in 2006, about 2,000 mt of fish was purchased for A$5.9 million, and 3,371 mt of fish, valued at A$8.4 million, was caught for subsistence purposes. Preston (2008) considered those estimates to be low, and did not use the results in his estimate.

A study commissioned by SPC included a short survey of one of the most important fisheries of the country, trolling for tuna in South Tarawa (Sullivan and Ram-Bidesi, 2008[1]). The results of that work show that the following:

- In mid-2008, 126 active full-time commercial tuna troll fishing craft operated out of South Tarawa, and 88 tuna troll fishing craft also participated on a sporadic basis.
- About 6,300 kg of tuna and related pelagic species were sold per day, on average – or 126 mt per month. To these commercial sales, approximately 5% should be added for domestic consumption, giving total landings of tuna of about 132 mt per month, or 1,584 mt per year.
- The market price of tuna was A$2.65 kg. Tuna sales accounted for about A$334,000 per month, or A$4 million per year.

Discussions with the Director of Fisheries in 2008 indicated that about 60% to 70% of coastal fisheries production in Kiribati is for subsistence purposes. The commercial component has expanded in recent years, due to increasing ice production in outer islands. Many islands now have cold storage (14 of 33 islands in Kiribati), enabling storage for local sale and shipment to Tarawa. (R. Awira, per .com. October 2008).

An IUCN study that has considerable relevance to valuing coastal fisheries in Kiribati was recently carried out under the MACBIO Programme, which is described in Box 9-1.

Box 9-1 : Economic Assessment and Valuation of Marine Ecosystem Services

This study aimed to determine an *economic value* of seven marine and coastal *ecosystem services* in Kiribati. It is part of the MACBIO (Marine and Coastal Biodiversity Management in Pacific Island Countries) project, which aims to improve the management of marine and coastal biodiversity in Pacific Island countries. The MACBIO project has undertaken national-level economic assessments of marine and coastal ecosystems in the five project countries. The work aimed to contribute to national development plans and marine resource management policies and decision-making. The report quantifies the value of seven marine and coastal ecosystem services in Kiribati: subsistence food provision; commercial food harvesting; mineral and aggregate mining; tourism; carbon sequestration; coastal protection; and research, management and education.

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.

Source: Rouatu et al. (2015)

1 The tuna trolling survey was carried out by Mike Savins, a fisheries specialist and long-time resident of Tarawa.

A description of the coastal fisheries results is provided in Table 9-1, below.

Table 9-1: The MACBIO Results Relevant to Kiribati Coastal Fisheries

Activity	Beneficiaries	Net annual value (A$) (2013 adjusted)	Sustainability
Subsistence fishing	I-Kiribati households, particularly outer islands. Value represents range from different data sources	9-34.5m	Abundant resources in outer islands with small populations; much overfishing in South Tarawa
Small-scale fishing for sale	I-Kiribati fishers and consumers, some restaurants and businesses (only value to fishers is estimated); logistical obstacles on outer islands, but some cold storage and transport investments are being made. Value range represents different sources	2.8–10m	Over-exploited resources near South Tarawa; transport and storage obstacles may reduce pressure on outer islands. Much waste due to lack of refrigeration
Bêche-de-mer, aquarium trade, and mariculture	Very small industries with small number of beneficiaries, but important to some people	< 1m	Unknown
Seaweed Mariculture	Many households on Kiritimati and Tabuaeran	Insufficient data	Unknown

Source: Rouatu et al. (2015)

The MACBIO results can be compared to those of the Gillett study (Table 9-2).

Table 9-2: Comparison of Annual Values for Fisheries Sub-Sectors in two Studies

	Gillett (2009) (for 2007)		**MACBIO** (uses data from 2006 to 2013)	
	Gross Value of Production (A$)	**Value Added**	**Gross Value of Production** (A$)	**Value Added** (A$)
Coastal Commercial	22,000,000	14,300,000	7 to 25 million	2.8 to 10 million
Coastal Subsistence	34,000,000	30,600,000	Between 10 and 38.5 million	9 to 34.5 million
Aquaculture	90,000	64,800	Insufficient data	Unknown
Total	**56,090,000**	**44,964,800**		

In general, the MACBIO fisheries production values are much less than those in the Gillett (2009) study.

The MACBIO results were based, to some degree, on per capita finfish consumption figures. The values used seem low. The report states: "The per capita consumption using a weighted average based on the island population is 74 kg. The total population of Kiribati was 103,058 in 2010 (KNSO 2012). Using that figure, 7.63 million kg (or 7,626 tonnes) of finfish are consumed per year by the people of Kiribati". Gillett (2009) examines a range of estimates for annual per capita fish consumption in Kiribati over many years, and concludes that most estimates fall into the range of 72 to 207 kg/person/year. In SPC's ProcFish surveys the average annual per capita consumption of finfish on four islands in Kiribati during 2004 was 106.9 kg, and 2.57 kg for invertebrates. The MACBIO fish consumption figures were extrapolated from data from unpublished Fisheries Department surveys in the period 2011 to 2013 at Aranuka, Butaritari, Nikunau, Tamana and Beru. The present survey considered a different set of unpublished data covering the same five islands, during the same period (K. Ientumoa, per. com. December 2015); the fish consumption figures on four of the five islands were much higher. Some other aspects of the MACBIO methodology, which indicate its unreliability, follow:

- There is some degree of dependence on the fisheries results of the 2006 HIES, but at least two fisheries studies examined the HIES and did not use the results. Even the MACBIO study stated: "There is very good information in the HIES. However, given the time constraints of the HIES, it is likely that the true value of subsistence fishing in the country is underestimated."
- An explicit assumption in the MACBIO study was that "50% of finfish consumption comes from self-caught finfish". The stated basis for this assumption is as follows: "An estimate of the amount of seafood purchased versus caught could not be located for Kiribati, but Bell et al. (2009) estimated for rural households in Fiji that 52% of seafood consumption came from subsistence."
- An unstated assumption in the MACBIO methodology is that the Fisheries Department's methodology used to determine fish catches on the five islands is sound and appropriately applied, and that data analysis was correct. Preston (2008) expresses some doubt about the veracity of the analysis.

From the above observations, there does not appear to be sufficient justification to embrace the MACBIO estimates of coastal fisheries production. The approach taken in the present study is to modify the Gillett (2009) results according to recent developments and factors that would affect coastal fisheries production.

The 2005 and 2010 census can be used to obtain an indication of changes in fishing effort in the five-year intervening period. Table 9-3 compares the number of boat-owning families between the two years. From the table it can be seen that, overall the number of boat-owning families increased by 90%, but South Tarawa experienced a fall in the number of such families.

Table 9-3: Change in number of Boat-Owning Households

	2005 - number of households owning at least one boat	2010 - number of households owning at least one boat	Change 2005 to 2010
All Islands	1280	2435	90%
Banaba	5	19	280%
Makin	18	91	406%
Butaritari	22	187	750%
Marakei	28	138	393%
Abaiang	51	225	341%
NTarawa	58	90	55%
STarawa	743	290	-61%
Maiana	14	48	243%
Abemama	52	68	31%
Kuria	10	16	60%
Aranuka	13	70	438%
Nonouti	29	94	224%
NTabiteuea	40	99	148%
STabiteuea	12	44	267%
Beru	13	178	1269%
Nikunau	12	163	1258%
Onotoa	18	171	850%
Tamana	5	98	1860%
Arorae	4	122	2950%
Teeraina	6	19	217%
Tabuaeran	38	99	161%
Kiritimati	86	106	23%
Kanton	3	0	-100%

Source: NSO (2006), NSO (2012)

Other changes affecting coastal fisheries in Kiribati over the last few years include the following:

- There has been a noticeable decrease in the fisheries production of Tarawa Lagoon, with a stark example being the ark shell (*Anadara sp.*, "te bun"). Campbell and Hanich (2014) report that, in the early 1990s, when harvestable quantities were high, commercial harvesters collected about 1,000 mt of clams annually around Tarawa. However, over-exploitation of the resource from both commercial and subsistence harvesting has led to collection levels of less than one-tenth of their former size, as well as speculation that the fishery has almost collapsed.
- There has been a decrease in the production of tuna and other pelagic species from trolling from small boats based in South Tarawa. One reason for this could be that the reject fish from tuna transshipment operations in Tarawa Lagoon has driven a number of tuna trollers out of business. (M.Savins, per. com. October 2015). Unpublished data from Central Pacific Producers (CPP) shows that 373.9 mt of reject fish were sold to the public in 2014.
- Several fisheries studies have shown a decrease in the abundance of important fisheries resources, such as: Purcel et al. (2012) for beche de mer, Basabe (2012) and MFMRD (2013) for aquarium fish on Christmas Island, and Siosi (2012) for finfish on Abemama Atoll.
- The trend of increasing commercialisation of Kiribati coastal fisheries production, as noted in Gillett (2009), continues. An increasing number of islands have refrigeration-enabling storage for local sale and shipment to Tarawa. (M. Kamatie, per. com. October 2015).
- There has been some mention of the purchase of reef fish from outer islands for frozen export to mainland China. While this could be having a positive temporary impact on local livelihoods, this may jeopardise long-term future food security (M. Blanc, per. com. October 2015).
- According to SPC's PRISM website data, the population of Kiribati has increased 14.1% between 2007 (the focal year for the Gillett [2009] study) and 2014 (the focal year for the present study). The long-term trend of rural to urban (South Tarawa) migration has eased.

The total production from Kiribati coastal fisheries are the catches for local consumption plus those catches that are exported. Gillett (2009) made a crude estimate of the export production from Kiribati coastal commercial fisheries in 2006: 1,142 mt (plus 144,000 pet fish), worth A$1.9 million. For 2014 it is more difficult to determine coastal fishery exports. Unlike the situation in 2006, in 2014 there was export of tuna, which is not separated in the export statistics from coastal fish, so it is not known how the 965 mt of "fish" exported in 2014 in the official export statistics is partitioned between coastal and offshore. The 2014 export data lacks information on pet fish and the information on the export of seaweed is very different from the amount given by the exporters.

The outer islands' 2014 buying prices for fish was obtained from CPP (T. Kaureata, per. com. October 2015). Finfish averaged A$1.65 to A$1.70, with invertebrate prices ranging from A$1.70 per kg (octopus) to A$13.50 (prawn). In Tarawa the skipjack and reef fish price was about A3.30/kg in 2014 (M. Savins, per. com. October 2015).[2]

The information in this section (and in general, the existing data on coastal fisheries in Kiribati) is entirely inadequate for making even a crude approximation of annual production. From the available information it is likely that, in recent years, the coastal fisheries of the country have become increasingly commercialised, the coastal fisheries production in Tarawa has dropped, and an increasing proportion of fish for consumption by Tarawa residents is from commercial fishing in the outer islands and from transshipment operations.

Using this information (and 2014 fish price information) to adjust the coastal fishery production in the Gillett (2009) study carries many difficulties. Nevertheless, carrying out such an exercise results in a 2014 total coastal fishery production of 19,000 mt, worth A$38,697,000 to fishers. This is comprised of:

- coastal commercial fishery production: 7,600 mt, worth A$18,861,000; and
- coastal subsistence fishery production: 11,400 mt, worth A$19,836,000.[3]

Coastal Subsistence Catches

Following the approach above, it is estimated that the production from coastal subsistence fisheries in Kiribati in 2014 was 11,400 mt, worth A$19,836,000 to fishers.

2 Prices used in the Gillett (2009) survey (A$2.96 commercial, A$2.50 subsistence) came from the 2006 HIES.
3 This is less than the Gillett (2009) study, primarily because of the buying prices of fish, with the 2014 prices considered to be more realistic.

Locally Based Offshore Catches

Although there are several Kiribati-flagged purse seiners and longliners, these are not based in Kiribati. Kiribati Fish Ltd. (KFL) has had longliners feeding fish into its Betio operation since 2012. It is difficult to determine the volumes and values of the catch of those longliners because the company has been unwilling to provide data to the present study, and their exports are combined with coastal fisheries exports in the official export statistics. In this situation, the most appropriate way to make an estimate of the volumes and values of locally based offshore catches is to rely on the observations of another Tarawa-based fish exporter. It is estimated that, in 2014, KFL exported 180 mt of loins by low temperature seafreight and 24 mt of high value loins by airfreight (M. Savins, per. com. November 2015). The pre-processing volume of that catch is estimated to be about 510 mt, with a value to fishers of about A$4.4 million.

Foreign-Based Offshore Catches

To use the data available to the present study to estimate foreign-based catches in the Kiribati zone requires the assumption that all of the catches by Kiribati-based longliners (given above) are made in the Kiribati zone. The foreign-based offshore catches can be calculated by using tuna catches and prices in FFA (2015) in conjunction with the catches of Kiribati-based offshore fishing from the above section. The values given in table 9-4 are adjusted to be in-zone values (i.e. overseas market prices less transport charges to those markets).

Table 9-4: Volumes and Value of Offshore Catches in the Kiribati Zone

	2010	2011	2012	2013	2014
Purse seine volume (mt)	211,693	197,318	534,308	282,466	679,294
Frozen longline volume adjusted for bycatch (mt)	5,054	8,685	10,055	3,676	15,741
Fresh longline volume adjusted for bycatch (mt)	3,806	6,323	8,492	4,714	6,033
Frozen longline value adjusted for bycatch and transport (US$)	22,741,807	39,083,709	45,245,745	16,544,008	70,832,509
Fresh longline value adjusted for bycatch and transport (US$)	25,691,729	42,680,700	57,322,386	31,817,651	40,719,375
Purse seine value adjusted for transport (US$)	311,497,379	290,344,882	786,212,315	415,637,492	999,554,575
Total volume all gears (mt)	**220,553**	**212,326**	**552,854**	**290,856**	**701,068**
Total value all gears (US$)	**359,930,916**	**372,109,291**	**888,780,447**	**463,999,151**	**1,111,106,458**

Source: FFA (2015)

From the table it can be seen that, in 2014, the offshore catch was 701,067 mt, with an in-zone value of US$1,111,106,458 (A$1,355,549,878).

Freshwater Catches

There are no freshwater fisheries in Kiribati.

Aquaculture Harvests

In the past there have been attempts to culture a wide variety of aquatic species in Kiribati, including seaweed, brine shrimp, cockles, mojarra, mullet, pearl oyster, tilapia and giant clams (Uwate, et al. 1984). Currently, the only significant aquaculture production is milkfish, seaweed and giant clams.

Milkfish on Tarawa

According to staff of the Ministry of Fisheries and Marine Resources Development (MFMRD) the production is between 100 and 200 fish per week, with the majority of buyers being Kiribati residents departing for overseas (M. Kamatie, per. com. October 2015). With a selling price of A$4/kg at the farm, the annual production is estimated to be 2.6 mt, worth A$10,400 at the farm gate. The Taiwan technical mission to Kiribati, "Ambo fish farm", has developed successful hatchery techniques for production of commercial quantities of milkfish fry for stocking outer island ponds and also, more recently, for exports to Nauru.

Milkfish on Christmas Island

The Kiritimati Integrated Fisheries Master Plan (MFMRD 2013) states that milkfish farming in Kiritimati Island has an average annual production of 15 mt, worth around A$40,000.

Giant clams

The sole producer of cultured giant clams in Kiribati exported 8,642 clams in 2014, at a free-on-board (FOB) price of about A$8.50 per clam (A$73,457 total). All clam exports in 2015 have been sold to Majuro Clam Farm and Kosrae Clam Farm. (M. Savins, per. com. October 2015).

Seaweed

The height of seaweed farming in Kiribati was in 2000, when about 1,500 mt worth A$900,000 was produced. In 2014 237 mt of seaweed worth was exported (NSO statistics). At the CCP Ltd buying price of A$0.70/kg (T. Kaureata, per. com. October 2015), the value to farmers was A$165,900.

The total Kiribati 2014 aquaculture production is estimated to be 255 mt, plus 8,642 pieces, worth A$289,757 to fishers/farmers.

Summary of Harvests

A crude approximation of the annual volumes and values[4] of the fishery and aquaculture harvests in 2014 can be made from the above sections (Table 9-5).

4 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.

Table 9-5: Annual Fisheries and Aquaculture Harvest in Kiribati, 2014

Harvest Sector	Volume (mt, and pcs where indicated)	Value (A$)
Coastal Commercial	7,600	18,861,000
Coastal Subsistence	11,400	19,836,000
Offshore Locally based	510	4,400,000
Offshore Foreign-based	701,067	1,355,549,878
Freshwater	0	0
Aquaculture (pcs and mt)	255 mt and 8,642 pcs	289,757
Total	**720,832 mt and 8,642 pcs**	**1,398,936,635**

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

Figures 9-1 and 9-2 show the volumes and values of the 2014 Kiribati fisheries production. Aquaculture is not shown in the volumes figure, due to the use of mixed units (pieces and mt).

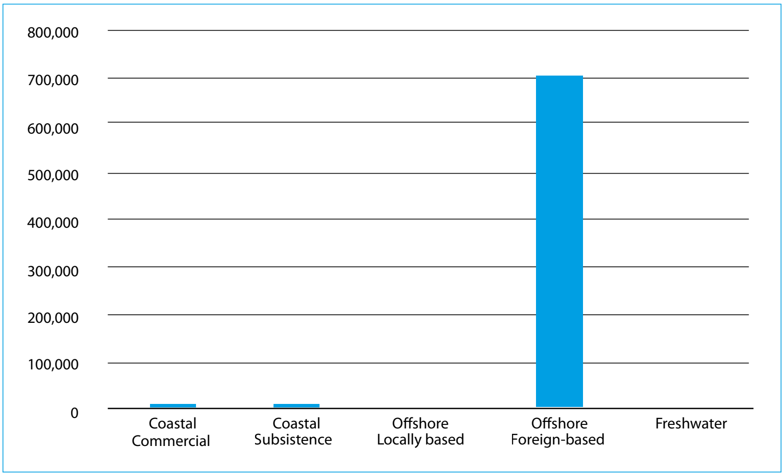


Figure 9-1 : Kiribati Fisheries Production by Volume (mt), 2014

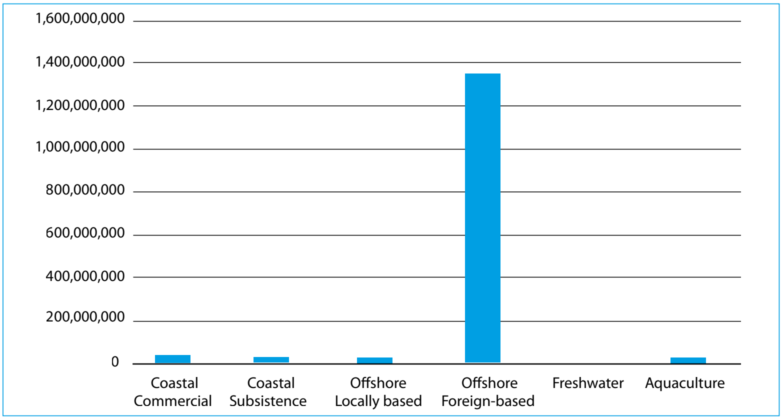


Figure 9-2 : Kiribati Fisheries Production 2014 by Value (US$)

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for the Kiribati from those three studies are presented in Table 9-6.[5]

The apparent changes in production for the three-year period represents a real change in production in some cases, but this can also represent a change in the methodology for measuring the 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) are likely to reflect real changes in the amounts being harvested.

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

Table 9-6: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, 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
Coastal Subsistence	1999	10,000	12,230,000
	2007	13,700	34,000,000
	2014	11,400	19,836,000
Offshore Locally based	1999	0	0
	2007	0	0
	2014	510	4,400,000
Offshore Foreign-based	1999	132,000	205,000,000
	2007	163,215	234,491,135
	2014	701,067	1,355,549,878
Freshwater	1999	n/a	n/a
	2007	0	0
	2014	0	0
Aquaculture	1999	n/a	n/a
	2007	143 mt and 100 pcs	90,000
	2014	255 mt and 8,642 pcs	289,757

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

9.2 Contribution of Fishing to GDP

Current Official Contribution

The official contribution of fishing to GDP is given in Table 9-7.

Table 9-7: Fishing Contribution to GDP (A$ thousands)

	2012	2013r	2014p
Central Pacific Producers (CPP)	284	740	2,212
Informal sector fishing for cash sales	5,047	5,157	5,270
Informal sector fishing for subsistence	8,413	8,596	8,783
Seaweed growers	282	285	287
Total fishing & seaweed	14,026	14,778	16,553
Total Kiribati GDP	180,510	182,467	192,851
Fishing/seaweed as a % of GDP	7.8%	8.1%	8.6%

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

Method Used to Calculate the Official Fishing Contribution to GDP

The notes accompanying the NSO GDP estimates contain some information on methodology, as follows:

- Information on informal fishing is from the 2006 HIES, which is corrected for future years by change in population and price of fish. From 2008 to 2014 the price used for fish remained at A$3.08/kg.
- CPP data is from company accounts.
- It is recognised that, under international convention (i.e. System of National Accounts, SNA), CPP is outside the fishing sector as it does not fish, but rather carries out processing and has retail sales.
- The official GDP does not consider non-seaweed aquaculture (i.e. giant clams and milkfish).

An information paper on the national accounts of Kiribati (NSO 2011) provides additional information on the methodology for calculating the fishing contribution to GDP, as follows:

> Many people in Kiribati fish for their own consumption and some fish for cash or for commercial purposes. There are also people who fish for both—for cash and for own consumption. Now to find these people or their total production, let alone differentiate their own consumption from their commercial activity, is very very difficult. Many of these do not need registration fees or licenses to operate—they just go out fishing on their boats or canoes anytime of the day, and if they catch a large number of fish they can either sell all of them or retain some for their own use. Now setting up the production account for this kind of activity is very difficult because there are no proper records of the catch and the sales. One way of obtaining information on these activities is to conduct a household income and expenditure survey but this is a fairly expensive exercise and in Kiribati only two household surveys have been conducted, one in 1996, and the second one in 2006. In other words, there is very little information on the informal commercial fishing in Kiribati. Although some estimates have been made based on the 2006 HIES, one should be very cautious when interpreting the trend and growth rates. This is basically because data for the other years are simply estimated by extrapolating the benchmark figures by the population estimates and price movements. Obviously more work is needed in this area.

Alternative Estimate of Fishing Contribution to GDP

Table 9-8, 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 9-5), 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 9-8, 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 9-8: Fishing Contribution to GDP in 2014, Using an Alternative Approach

Harvest Sector	Gross Value of Production (A$, from Table 9-5)	VAR	Value Added (A$)
Coastal Commercial	18,861,000	0.65	12,259,650
Coastal Subsistence	19,836,000	0.90	17,852,400
Offshore Locally based	4,400,000	0.20	880,000
Freshwater	0	0	0
Aquaculture	289,757	0.72	208,625
Total	**43,386,757**	----	**31,200,675**

The fishing contribution to GDP – A$31.2 million – is 16.2% of the A$192.9 million GDP of Kiribati in 2014.

The 2014 fishing contribution to GDP, in Table 9-8 (A$31.2 million), is considerably greater than the official fishing contribution to GDP of A$16.6 million, given in Table 9-7. 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. Conversely, the output of CPP (which does not carry out fishing, and is therefore not a part of the fishing sector) is considered as part of the official fishing contribution.

9.3 Exports of Fishery Production

The official exports of Kiribati, kindly provided by the NSO, are given in Table 9-10.

Table 9-10: Value of Fishery Product Exports (A$ thousands)

	2009	2010	2011	2012	2013	2014
Fish				44	263	3025
Pet fish	926				70	
Sharkfins	462	143	210	78	2	28
Seaweed	360	47	428		212	256
Beche de mer	1536	731	539	765	287	54
All above fishery exports	3284	921	1177	887	834	3363
All exports	5970	2899	7144	4876	4182	8426
Fishery exports as a % of all exports	55.0%	31.8%	16.5%	18.2%	19.9%	39.9%

Source: NSO (unpublished data)

The above table is incomplete, in that it does not contain pet fish exports in 2014, and also appears to be inaccurate. The A$3.0 million given for the exports of "fish" consists of both coastal fish exports and the exports from locally based offshore vessels. For the latter, an earlier section of this chapter gives the pre-processing value of those fish as A$4.4 million, with the FOB price much greater; accordingly, the value of "fish" for 2014 in the above table is too low. In addition, the A$73,457 of giant clam exports in 2014 given in the aquaculture section above is not listed in the table.

9.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

The Ministry of Finance and Economic Development Annual Report 2014 (MFED 2015) states:

> The total recurrent revenue collected in 2014 was $187.84 million. This is $109.08 million over the total revenue budget estimate of $78.76 million. The significant increase in revenue is due to fishing licenses which rose to $141.57 million. Total revenue from fishing license fees exceeded its budget by $103.57 million and reflected the move to the Vessel Day Scheme which has had a significant impact on fishing revenue. Total revenue from all fishing sources was $142.68 million. The taxation base is very low and therefore revenue raised through personal income taxes and company taxes are also low. Non-compliance with regard to company taxes has been a

> continuing problem which leads to less than adequate government taxation revenue. Fisheries license fees are the major source of revenue with 75% of total government revenue from that source in 2014.

The Ministry of Finance and Economic Development Annual Report 2014 (MFED 2015) also contains the following statement:

> As a result of the economic reforms and reforms to state owned enterprises, for the first time, Budget Support of $10.4 million was provided by the World Bank, New Zealand and the ADB. The support was based on the Government of Kiribati meeting agreed targets in the economic reform program including....A joint report on sources of fisheries revenue produced by the Ministry of Fisheries and Marine Resource Development and MFED. This report is available on the MFED website.

That report, "Fishing License Revenues in Kiribati", contains the statement: "The review has been undertaken to ensure that the revenue benefits to the Government of Kiribati from the issuance of fishing licenses have been maximized." (MFED & MFMRD, 2014). The report contains the access fees for 2004 to 2013 (Table 9-11).

Table 9-11: Access Fees for Foreign Fishing

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Nominal A$ millions	29.4	25.0	25.8	25.4	31.2	29.5	41.7	29.1	58.3	89.0
Nominal US$ millions	21.7	19.0	19.4	21.3	26.7	23.4	38.4	30.1	60.4	86.1

Source: MFED and MFMRD (2014)

Other Government Revenue from Fisheries

Unpublished data from the Ministry of Finance and Economic Development shows all fisheries-related revenue in 2014 (Table 9-12).

Table 9-12: Fisheries Revenue in 2014 (A$)

Account Code	Account Name	Revenue
C21030000010	Vessel and Equipment Hire	3,254.50
C21030000040	Fish and fish poster sales	30,680.25
C21030000041	Local Fishing	69,377.85
C21030000042	Local Licencing	41,611.40
C21030000043	Fish transshipment fees	963,591.07
C21030000045	Fishing License Revenue	141,573,749.90
	Grand Total	**142,682,264.97**

Source: MFED (unpublished data)

It can be seen that, in 2014, the fees for fish transshipment were the second-most important source of fisheries revenue for the government. The large amount of transshipment during that year (as well as the large amount of access fees) was due to the El Niño conditions that prevailed during 2014. SPC unpublished data shows that, from logsheet data, 297 purse seine fishing trips had Tarawa as the port of return, which usually means that a transshipment occurred. Purse seine transshipment fees have recently increased, from US$6 to US$40 per mt (B. Onorio, per. com. October 2015), resulting in many purse seiners transshipping in ports outside Kiribati (along with efforts by the Kiribati government to encourage them to return). The Kiribati government has the policy that during purse seine transshipment operations all rejected fish must be given to the government-owned Central Pacific Producers. Unpublished CPP data shows that, in 2014, 373.9 mt of rejected fish was sold by CPP to the public, for A$448,716.

9.5 Fisheries-Related Employment

The Kiribati 2010 Census of Population and Housing (NSO 2012) contains some fisheries-related employment information. Table 9-13 (extracted from a large table in the census report) provides the major categories of fisheries jobs, broken down by the age and sex of the workers.

Table 9-13: Fisheries-Related Employment Information by Sex, Age, and Occupation

	Total	Both sexes				Male				Female			
Age (years)➤ Job category ⯆	All	15-24	25-34	35-49	50 +	15-24	25-34	35-49	50 +	15-24	25-34	35-49	50 +
Fishing guides	14	3	4	4	3	3	4	4	3	0	0	0	0
Seaweed farmers	126	38	27	44	17	22	18	29	11	16	9	15	6
Coastal fisherman	2730	751	749	845	385	707	715	787	362	44	34	58	23
Other fisheries workers (Kereboki etc.)	152	37	49	43	23	31	39	27	12	6	10	16	11
Deepsea fisherman	122	30	34	45	13	29	32	42	12	1	2	3	1
Other fisheries workers	7	2	5	0	0	1	4	0	0	1	1	0	0
Fishery assistants	27	5	9	11	2	5	6	6	2	0	3	5	0
Total	3178	866	877	992	443	798	818	895	402	68	59	97	41

Source: 2010 census

The data in the table appears to underestimate the numbers of workers in some types of jobs. The "deepsea fisherman" category serves as an example. "Deepsea fisherman" is not defined in the census report, but if it refers to fishing in the open ocean from skiffs, the 2008 South Tarawa survey described in the coastal fisheries section above (Sullivan and Ram-Bidesi 2008) shows that more than three times the number of people fish in the open ocean than that indicated in the 2010 census (i.e. 126 active full-time commercial tuna troll fishing craft, plus 88 part-time). If "deepsea fisherman" refers to people who work on offshore fishing vessels, there are at least twice that number working on just the Japanese pole-and-line fleet. (Gillett 2015).

The usefulness of the 2010 census for fisheries purposes is constrained, to some extent, by the use of an aggregated category. The census reports some results in the grouping "skilled agriculture and fisheries workers", making it difficult to identify the number of people in fisheries-related employment.

A change in the level of boat ownership could, to some extent, reflect a change in fisheries participation. Table 9-3, in the Kiribati coastal fishing section, above, indicates the changes, between 2005 and 2010, in the number households that own a boat. Overall, the number of boat-owning families increased by 90% in that period. A decline was recorded only for South Tarawa and Kanton. The number of households that owned boats increased on all other islands, with six islands recording an ownership increase of more than 500% (Butaritari, Onotoa, Nikunau, Beru, Tamana and Arorae).

SPC's ProcFish programme surveyed four sites in Kiribati (Awira et al. 2008). Table 9-14 is an extract from the report of the survey showing the importance of both reef fisheries and the sale of fish.

Table 9-14: Involvement with Fisheries at the ProcFish Sites

	Households involved in reef fisheries	Households with fisheries as the most important source of income
Abaiang	100%	56%
Abemama	96%	24%
Kuria	91%	17%
Kiritimati	92%	36%
Average across the 4 sites	95%	34%

Source: Awira et al. (2008)

SPC (2013) uses ProcFish data to examine the ratio of men to women fishers across the Pacific. For the Kiribati sites examined, about 65% of fishers are men and 35% are women.

The Forum Fisheries Agency has a programme – Economic Indicators Project – that collects data on tuna-related employment in standard format. FFA (2015) contains information on the employment of people from Kiribati in the tuna industry (Table 9-15). A total of 795 I-Kiribati were employed in the tuna industry in 2014. Across the Pacific a total of 17,663 people were employed as crew on tuna vessels or in tuna processing and ancillary work. Tuna-related employment in Kiribati therefore represents 4.5% of the regional tuna employment.

Table 9-15: Tuna-Related Employment in Kiribati

	2008	2009	2010	2011	2012	2013	2014
Processing and ancillary	10	3	7	15	57	75	75
Local crew	66	106	126	158	223	355	720
Total	**76**	**109**	**133**	**173**	**280**	**430**	**795**

Source: FFA (2015)

Many Kiribati men work on foreign-based offshore fishing vessels. Although there has not been a census of that type of work since an FFA study in 1997, a recent report on the trends in offshore fishing vessel employment opportunities for Kiribati (Gillett 2015) states: "The available information suggests that the opportunities for Kiribati crew have shifted. In general, Asian purse seining is rising while the original mainstay of Kiribati crew employment, the Japanese pole-and-line fleet, is contracting. Korean longlining (a source of significant I-Kiribati employment in the past) is also contracting."

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, ranging from 112 to 312 mt 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 percent) of the islands have a per capita consumption of fish greater than one kg per day (i.e. greater than 365 kg/person/year).

- According to IMM (1993), the estimated catch in the Gilbert Group of Islands translates to an annual fish supply of 207 kg per capita.
- World Bank (1995), quoting 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."
- World Bank (2000) recounts that, in Kiribati, 67 percent of total animal protein is from seafood.
- Using 1995 FAO production, import, and export data, Preston (2000) calculates that the annual per capita supply of seafood is 150 kg
- 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 ProcFish surveys at Abaiang, Abemama, Kuria and Kiritimati (Awira et al. 2009) 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 241g 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 mt 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 indicates: "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. (2009) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES 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 the period 2011 to 2013 at Aranuka, Butaritari, Nikunau, Tamana and Beru. The section above on Kiribati coastal fishing presents some arguments about why the 74 kg could be considered too low.

A relatively recent addition to the fish supply in Tarawa derives from the Kiribati government's policy of requiring all fish rejected during purse seine transshipment operations to be given free to the government-owned CPP. 373.9 mt of rejected fish was sold by CPP to the public in 2014 (unpublished CPP data), which represents around 7.5 kg per capita of rejected fish, which is sold to residents of South Tarawa and Betio annually.

Several features emerge from the above fish consumption studies:

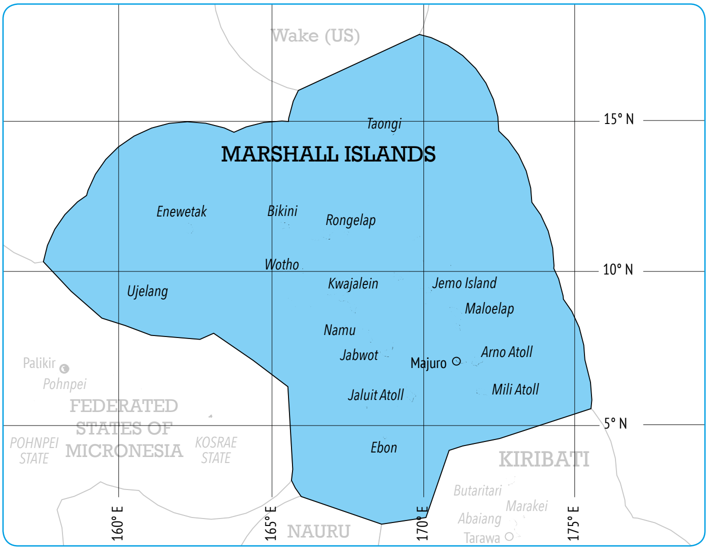
- There is a large amount of variation in annual per capita consumption rates between studies, and between islands within studies.
- Some of the earlier studies indicate that Kiribati has the highest rate of fish consumption compared to any country in the world.
- Some of the studies that produced low fish consumption rates could have used the food weight of the 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 report are as follows:

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.36	1.31	1.32	1.19	1.10	1.12	0.10	0.98	0.96	1.12	1.22

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 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 mt (worth US$714,504) and subsistence production of 2,000 mt (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 mt (worth US$973,000) and subsistence production of 2,800 mt (worth US$3,836,000).
- Gillett (2009) considered the above two estimates as well as the following more recent information: (a) Information on the purchases of fish in the outer islands by Marshall Islands Marine Resource Authority (MIMRA), (b) The 2002 HIES, (c) 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 mt, worth US$2.9 million. The commercial was about 25% of all coastal fisheries production (i.e. the subsistence fisheries production in the countries was judged to be about 2,800 mt).

A study in 2010 (Echigo 2010) estimated the 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 2008 & 2009, and (e) population data from the 1999 census. The results of the study are given in Table 10-1.
The Echigo study did not include exported fishery products, such as aquarium fish, beche-de-mer, and trochus (F. Edwards, per. com. Sept 2015). It is assumed that the total coastal fisheries production in the country estimated by the study (about 4,500 mt) is comprised of catch used for both subsistence and commercial purposes.

The Gillett (2009) study estimated that the commercial production was about 25% of all production in the country, but the information presented below suggests that this percentage has increased in recent years.

There have been changes in Marshall Islands in the period since the above studies that are likely to have affected coastal fisheries production. Some of these are:

- Two SPC surveys of reef fish abundance in Majuro lagoon (2007 and 2011) suggest that the abundance of finfish and invertebrates has decreased (Moore et al., 2012). Other studies have commented on over-exploitation of fishery resources at locations close to urban areas (e.g. Rhodes et al. 2011, Newton et al. 2007)

Table 10-1 : Estimates of Coastal Fishery in the Echigo Study

Atoll / Island	Population	Total Catch / year (lbs)	Total Catch / year (kg)
Majuro	23,676	3,738,289	1,697,183
Kwajalein	10,902	1,032,814	468,897
Arno	2,069	1,021,318	463,678
Jaluit	1,669	199,736	90,680
Maloelap	856	106,772	48,474
Aur	537	71,532	32,475
Likiep	527	165,520	75,146
Ailinglaplap	1,959	615,282	279,338
Namu	903	283,614	128,761
Ailuk	513	179,525	81,504
Namdrik	772	270,162	122,654
Mili	1,032	361,149	163,962
Ebon	902	315,656	143,308
Wotje	866	303,058	137,588
Enewetak	853	298,508	135,523
Mejit	416	145,580	66,093
Kili	774	270,862	122,971
Ujae	440	153,978	69,906
Utirik	433	151,529	68,794
Lae	322	112,684	51,159
Lib	147	51,443	23,355
Wotho	145	50,743	23,037
Jabat	95	33,245	15,093
Rongelap	19	0	0
Bikini	13	0	0
Ujelang	0	0	0
	50,840	9,932,998	4,509,581

Source: Echigo (2010)

- Discussions with MIMRA staff knowledgeable in coastal fisheries indicate that, in recent years, there has been an increase in fish trade between the outer islands and Majuro. Church groups and local government councils are involved in this practice. In addition, one commercial company is now buying from outer islands – about 10,000 pounds of fish per trip.(F. Edwards, per. com. Sept 2015)
- MIMRA continues its efforts to bring fish from the outer islands to population centres. The 2014 MIMRA Annual Report (MIMRA 2015) indicates that two outer island fish buying schemes in 2014 purchased 62,260 kg of fish at US$2.33 per kg (US$145,326 total). About the same was purchased by those schemes in 2013 (MIMRA 2014). The annual purchases in the outer islands by MIMRA in 2013 and 2014 are about twice those made during the years covered by the Gillett (2009) study.
- Between the focus year of the Gillett 2009 study (2007) and the focus year of the present survey (2014) the population of the country has increased by 2.7% (SPC PRISM website data).

The above facts are generally relevant to the types of coastal commercial fisheries production that are consumed domestically. Therefore, in estimating total coastal commercial production, exports of products that are not typically consumed in Marshall Islands must be considered. The readily available information on these commodities consists of the following:

- There are currently about five or six active aquarium businesses in the country. They export mainly aquarium fish, with some cultured coral. Live rock exports ceased in 2007.
- The MIMRA 2014 annual report states: "The marine ornamental trade saw significant growth in exports during FY2014[1], with angel fish (Pomacanthidae) exports increased from about 15,000 in FY2013 to over 50,000 in FY2014" (MIMRA 2015). The MIMRA 2013 annual report states: "Pomacanthidae (angel fish) accounting for over half of the exports for the aquarium trade".
- In 2014 there were no legal exports of beche-de-mer (but likely some leakage). There were about 9 mt of trochus exported that year. (F. Edwards, per. com. Sept. 2015)

1 A fiscal year in the Marshal Island is from 1 October to 30 September.

- Assuming that the above information is reasonably accurate, a crude estimate of the dockside value of exports of aquarium fish and trochus in 2014 is about US$600,000.

Selectively using the information given in this section, and according moderately high credibility to the Echigo (2010) study, a crude estimate of the total coastal fisheries production in Marshall Islands in 2014 is 4,500 mt, of which the commercial fisheries component is 1,500 mt. Considering the MIMRA buying prices in the outer islands and prices paid to fishers in Majuro, the dockside value of the 2014 coastal commercial catch is about US$4,350,000.

This represents a considerable increase from the Gillett (2009) study. Part of that increase is due to better information from the Echigo (2010) study and part can be attributed to increased commercialisation of the coastal fisheries in Marshall Islands.

Coastal Subsistence Catches

In the Gillett (2009) study it was estimated that coastal subsistence fishery catches made up 75% of all coastal catches (i.e. 25% is commercial). In the preceding section information is presented to show increased commercialisation. In view of that development, coastal subsistence catches are estimated to be about two-thirds of all coastal fisheries production, or about 3,000 mt in 2014. The value of the subsistence production (using the "farm gate" method described in Section 3-1, above) is estimated to be US$6 million per year.

Locally Based Offshore Catches

The Marshall Island paper (MIMRA 2015), submitted in mid-2015 to the Scientific Committee of the Western and Central Pacific Fisheries Commission, states:

> The Republic of Marshall Islands (RMI) continued to operate ten purse seine vessels fishing throughout the Western and Central Pacific Ocean (WCPO). The total catch by the national purse seine fleet in 2014 was 79,562 metric tonnes mt of which 18% was taken within the RMI EEZ. There was no national longline catch recorded as the longline vessels formerly flagged to the RMI were reflagged to the FSM in 2013.

That paper gives information on the number of Marshall Islands tuna vessels in the recent past (Table 10-2).

Table 10-2: Numbers of Marshall Islands-Flagged Fishing Vessels Active in the WCPO

	Longline				Purse seine			
GRT>	0-10	10-50	50-200	200-500	0-500	500-1,000	1,000-1,500	1500+
2010	0	0	4	0	0	0	7	3
2011	0	0	4	0	0	0	7	3
2012	0	0	4	0	0	0	7	3
2013	0	0	3	0	0	0	7	3
2014	0	0	0	0	0	0	7	3

MIMRA (2015) also contains information that shows that more than 98% of the 127 transshipments by the purse seiners were carried out in Majuro, demonstrating that the vessels were indeed based in Marshall Islands.

MIMRA (2015) states that the domestically based foreign longline fleet comprises vessels from China, Chinese Taipei and FSM. Those vessels were operated under Marshall Islands Fishing Venture Ltd., which is a subsidiary of Luen Thai. All longliners that operate in the Marshall Islands zone are based in Majuro, except for the Japanese longline vessels, which offload their catch in ports in Japan. In 2014 the locally based longliners exported 3,678 mt of bigeye, 1,428 mt of yellowfin, and 30 mt of other species. That fleet disposed locally of 153 mt of bigeye, 317 mt of yellowfin, 114 mt of albacore, and 637 mt of other species. In total the longliners landed 6,356 mt of fish. Using destination export fish prices in FFA (2015) discounted by 25% to approximate dockside prices and a flat US$2/kg for all local sales, the dockside value of the 2014 catch by locally based longliners was about US$39,000,000.

MIMRA (2015) gives the 2014 catch of Marshall Islands purse seine fleet as 79,562 mt. FFA (2015) gives the Thai import value of that catch as US$113,624,676. With transshipment costs of US$240 per mt from Majuro to Bangkok, that equates to a Majuro dockside value of about US$94,530,000.

Foreign-Based Offshore Catches

The only foreign-based longlining in the Marshall Island zone in 2014 was by vessels from Japan (MIMRA 2015). That fleet caught a total of 451 mt of fish in 2014, which comprised 17 mt of albacore, 278 mt of bigeye, 112 mt of yellowfin, and 44 mt of other fish. Using pricing information in FFA (2015), and discounting 15% for transport from Marshall Islands zone to Japan, the in-zone value of the 2014 Japanese longline catch is about US$3,900,638.

MIMRA (2015) gives the total purse seine catch in Marshall Islands zone in 2014 as 43,571 mt, of which 14,268 mt was by locally based seiners (i.e. Marshall Islands-flagged), giving a foreign-based purse seine catch of 29,303 mt. Using the purse seine catch valuation methodology described above, the foreign-based purse seine catch in Marshall Islands zone in 2014 was worth about US$34,800,000

Freshwater Catches

There are no freshwater fisheries in Marshall Islands.

Aquaculture Harvests

Hambrey Consulting (2011) states that current aquaculture production in Marshall Islands consists of a relatively steady but small production of tridacnid clams for the aquarium market, as well as small amounts of hard and soft corals for the same aquarium trade, and sporadic production of black pearls. Annual revenues to the country are in the order of a few tens of thousands of dollars, but this varies greatly between years.

With respect to actual production of giant clams:

- Hambrey Consulting (2011) states: “Production figures are potentially confusing: MIMRA annual reports and interview data produced for SPC (Ponia 2010) suggest around 30,000 and up to 90,000 clams are sold per year. However, export permit records, CITES records and, most crucially, the sole exporter’s own records, suggest the most accurate estimate would be considerably lower - in the region of 6,000–15,000 per year.”
- The CITES export database shows the giant clam exports of the country: (a) 2011: 18,540 live tridacna exported (300 originated from FSM); (b) 2012: 12,995 live tridacna exported; and (c) 2013: 11,197 live tridacna exported.
- The MIMRA 2014 annual report (MIMRA 2015) indicates that in FY2014, exports of *Tridacna derasa* increased to over 4,000 compared to about 1,500 in FY2013, while *Tridacna maxima* rose to 3,500, from about 1,000 the previous year.

- Using pricing information supplied by MIMRA, the approximately 7,500 giant clams exported in 2014 would be worth about US$30,000 at the farm gate.

With respect to actual production of pearls:

- Hambrey Consulting (2011) states: "Pearl production can be best described as sporadic, with significant harvests over the last decade only in 2001, 2005 and 2010… The best estimate for the pearl harvest in 2010 is therefore 1,885 pearls, with a farm gate value of$82,000".
- MIMRA staff report that the pearl farm on Majuro has closed, and in 2014 there was only limited commercial production of pearls from the farm on Namdrik Atoll (F. Edwards, per. com. Sept 2015).

Soft and hard corals are also cultured in Marshall Islands. Production is estimated at around 1,500 pieces per year, with a value of around US$13,000. (Hambrey Consulting 2011). The 2013 MIMRA annual report (MIMRA 2014) states that MIMRA provided export permits for over 16,000 pieces of coral during the year. The CITES database indicates that 8,485 pieces of live coral were exported in 2013, however all but 2,490 originated from Federated States of Micronesia.

For the purpose of the present study, annual aquaculture production in Marshall Islands in 2014 is estimated to be 10,000 pieces, worth US$50,000.

Summary of Harvests

From the above sections, a crude approximation of the annual volumes and values[2] of the fishery and aquaculture harvests in 2007 can be made (Table 10-3)

Table 10-3: Annual Fisheries and Aquaculture Harvest in Marshall Islands, 2014

Harvest Sector	**Volume** (mt, and pcs where indicated)	**Value** (US$)
Coastal Commercial	1,500	4,350,000
Coastal Subsistence	3,000	6,000,000
Offshore Locally based	85,918	133,530,000
Offshore Foreign-based	29,754	38,700,638
Freshwater	0	0
Aquaculture	10,000 pcs	50,000
Total	**120,172 mt and 10,000 pcs**	**$182,630,638**

2 A fiscal year in the Marshal Island is from 1 October to 30 September.

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 the 2014 Marshall Islands fisheries production. Aquaculture is not shown on the volumes figure, due to the use of mixed units (pieces and mt).

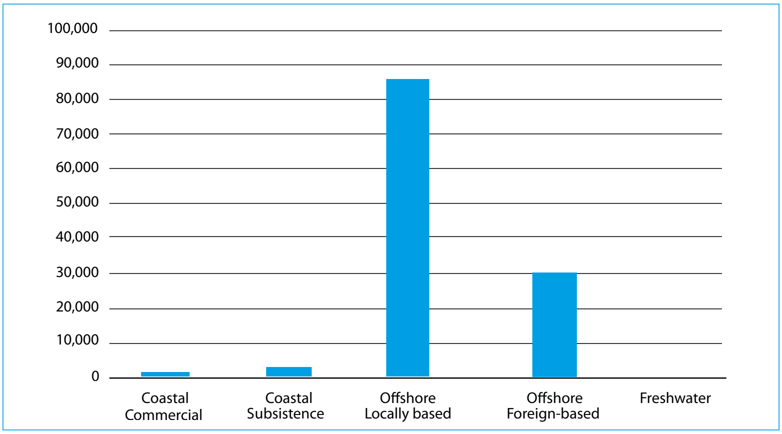


Figure 10-1: Marshall Islands Fisheries Production 2014 by Volume (mt)

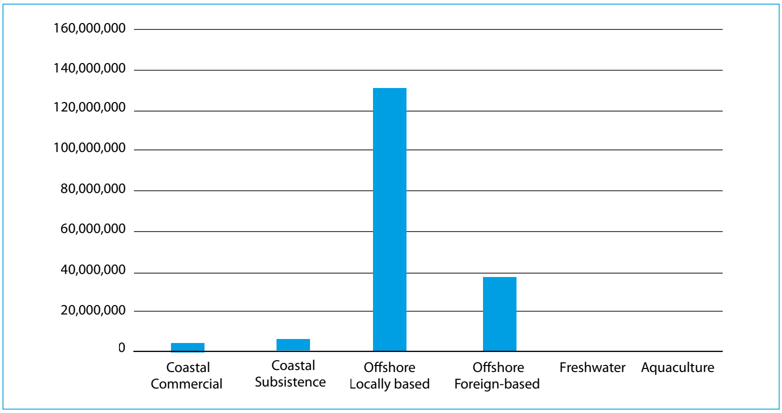


Figure 10-2: Marshall Islands Fisheries Production 2014 by Value (US$)

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for Marshall Islands from those three studies are given in Table 10-4.[3]

Table 10-4: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvests Sector	Estimate Year	Volume (mt, and pcs where indicated)	Nominal Value (T$)
Coastal Commercial	2007	950	2,900,000
	2014	1,500	4,350,000
Coastal Subsistence	1999	2,800	3,836,000
	2007	2,800	4,312,000
	2014	3,000	6,000,000
Offshore Locally based	1999	0	0
	2007	63,569	81,210,390
	2014	85,918	133,530,000
Offshore Foreign-based	1999	33,217	50,000,000
	2007	12,727	19,572,712
	1999	29,754	38,700,638
Freshwater	1999	n/a	n/a
	2007	0	0
	2014	0	0
Aquaculture	1999	n/a	n/a
	2007	25,000 pcs	130,000
	2014	10,000 pcs	50,000

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the 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, 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) are likely to reflect real changes in the amounts being harvested.

3 The earliest Benefish Study, Gillett and Lightfoot (2001), did not include aquaculture, freshwater fisheries or the non-independent territories.

10.2 Contribution of Fishing to GDP

Current Official Contribution

The national accounts of Marshall Islands are given in Graduate School (2015), from which the contribution of fishing to Marshall Islands GDP can be obtained.

Table 10-5: The Fisheries Component of the GDP of Marshall Islands (US$ millions)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Fisheries component of GDP	8.9	12.2	18.5	20.8	32.2	32.0	26.3
Marshalls GDP	152.8	152.1	163.8	172.9	184.4	190.2	186.7
Fisheries as % of Marshalls GDP	5.8%	8.0%	11.3%	12.0%	17.5%	16.8%	14.1%

Source: Graduate School (2015)

The FY2014 Statistical Compendium (including 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 individuals in the Graduate School responsible for the national accounts have a considerable amount of expertise and years of experience in Micronesia. For various reasons, as described in Section 31-4 of this book, those individuals have treated the fishing sector in Marshall Islands somewhat differently than, for example, the International Monetary Fund, and the descriptions in Appendices 2 and 3 of this book (hence the reference to "fisheries" rather than "fishing" in Table 10-5, above). In summary, the major changes the Graduate School has made are: (a) excluding from the fishing sector of Marshall Islands most of the current, locally based industrial fishing vessels; and (b) including in the fishing sector industrial fish processing operations (e.g. the Pan Pacific loining plant).

In calculating the fisheries component of GDP, the Graduate School used the 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. To some extent, for the non-industrial fishing (e.g. coastal commercial and coastal subsistence) the Graduate School used the gross value of production and the value added from the Gillett (2009) study.

Alternative Estimate of Fishing Contribution to GDP

Table 10-6, 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 10-3), and determines the value added by using value added ratios (VARs) that are characteristic of the type of fishing concerned. Those VARs were determined using a knowledge of the fisheries sector, and by using specialised studies (Appendix 3).

It is not intended that the approach in Table 10-6 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 10-6: Fishing Contribution to GDP in 2005/06 Using an Alternative Approach

Harvest Sector	Gross Value of Production (US$, from Table 10-4)	VAR	Value Added (US$)
Coastal Commercial	4,350,000	0,75	3,262,500
Coastal Subsistence	6,000,000	0.85	5,100,000
Offshore Locally based			
Longline	39,000,000	0,20	7,800,000
Purse seine	94,530,000	0,50	47,265,000
Freshwater	0	0	
Aquaculture	50,000	0,55	27,500
Total ($T)			**55,092,500**

Source: Production sections, above

The US$55.1 million fishing contribution to GDP in 2014, shown in the table above is considerably greater than the US$41.8 million estimated for 2007 in the Gillett (2009) study. It is also much greater than the official contribution of "fisheries" of US$26.3 million for FY 2014 given in Graduate School (2015).

The major difference between Graduate School (2015) and Gillett (2009) is obviously that the official estimate includes industrial fish processing and excludes most of the operations of the locally based industrial fishing vessels. There are advantages in the respective methodologies of each study. The former is oriented towards obtaining a picture of the entire national economy – and the ups/downs of industrial tuna fishing may distort other important changes in the economy. The present study is fisheries-oriented, and as such it is important for tracking the economic contribution of locally based fleets – something that most countries in the region (including Marshall Islands) have been promoting for many years. Also, it is important for comparison purposes that the present study uses a methodology consistent with Gillett (2009).

10.3 Exports of Fishery Production

Marshall Islands exports can be considered as essentially fisheries products, copra and coconut oil, and re-exported items. Only the first two items[4] are considered here. Graduate School (2015) gives information on those exports in recent years (Table 10-7).

Table 10-7: Fishing Contribution to GDP in 2014 Using an Alternative Approach

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Copra/ coconut oil	4.4	2.0	2.4	3.6	3.0	3.2	2.7
Fish	0.8	2.8	8.5	19.6	24.8	21.0	14.6
Coconuts and fish	5.2	4.8	10.9	23.2	27.8	24.2	17.3
Fish as a % of all major exports	15.4%	58.3%	78.0%	84.5%	89.2%	86.8%	84.4%

Source: Graduate School (2015)

Some additional information is available on the 2014 fishery exports:

- Pan Pacific loining plant exports: 466 mt of loins ($2.175 million in exports in 2014), 3,061 mt of whole skipjack and yellowfin ($4.240 million), and 241 mt of fishmeal ($0.269 million) (Graduate School 2015).
- Exports from locally based longliners: 3,678 mt of bigeye, 1,428 mt of yellowfin, and 30 mt of other species (MIMRA 2015). Using the pricing method described in the locally based offshore section above, the dockside prices of this fish was about US$37.4 million.
- Virtually all of the aquaculture production is exported. The aquaculture section, above, gives the 2014 aquaculture production as 10,000 pieces, worth US$50,000 at the farm gate.
- Exports of trochus and marine aquarium ornamentals in 2014 are worth about US$600,000 (as indicated above).

4 The re-export category is distorted by occasional sales of large items (e.g. used ships).

- There are significant commercial exports of reef fish. Information on 2014 exports are not available, but MIMRA (2014) gives the 2013 frozen reef fish exports as 24.3 mt – at US$4 per kg, that is worth US$97,200.
- An unknown, but probably significant, amount of mainly reef fish is exported informally, carried as baggage on flights to overseas destinations.

Using the items above (but without considering informal exports), the value of the 2014 fishery exports of Marshall Islands appears to be about US$44.8 million. This equates to 94% of the major exports of Marshall Islands (fish and coconut products).

International trade statistics (www.trademap.org/tradestat), compiled by using data from both exporting and importing countries, show that US$121.2 million of fishery products originated from Marshall Islands in 2014.

It is difficult to reconcile the above three very different estimates of the 2014 fishery exports of Marshall Islands: US$14.6 million; US$44.8 million; and US$121.2 million. It is not clear what the US$14.6 million estimate[5] is comprised of. The reason for the difference between the US$44.8 million and US$121.2 million estimates could be that the latter figure is based on considering the transshipment of fish in Majuro by Marshall Islands-flagged seiners as exports of Marshall Islands.

10.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

The MIMRA annual reports contain detailed information on access fees. This is given in various categories. 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.
- "License fee collections" = 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.

5 Subsequent discussions with a member of the Graduate School team indicates this consists of $14.6 million exports from the loining plant, and 3 associated "resident" vessels, plus $0.8 million estimate for exports of other fishery products (G. McKinlay, per. com. November 2015).

Table 10-8: Access Fees for Foreign Fishing Activity (US$)

	2011	2012	2013	2014
Fishing rights	2,116,371	3,071,879	2,478,875	3,383,643
VDS revenue	3,636,500	2,865,099	7,746,478	12,171,596
License fee collections	1,415,952	1,410,236	1,140,200	1,363,549
Total	**7,170,834**	**7,349,226**	**11,367,566**	**16,920,802**

Source: MIMRA (2014), MIMRA (2015)

Total revenue of the Marshall Islands government in 2014 was US$102.9 million (Graduate School 2015). The access fees given in the table above therefore represent 16.4% of government revenue during the year.

Other Government Revenue from Fisheries

The MIMRA annual reports and unpublished data give other types of revenue received by the government from fishing activity (Table 10-9)

Table 10-9: Other Fees (Non-Access) from Fishing Activity (US$)

	2011	2012	2013	2014
Transshipment fees	312,000	272,500	413,000	547,000
Fishing violation fines	10,000	335,000	870,000	825,000
Observer fees	370,601	397,749	261,286	561,924
Others	11,508	33,319	38,813	146,523
Total	**706,120**	**1,040,580**	**1,585,112**	**2,082,461**

Source: MIMRA (2014), MIMRA (2015)

Another form of government revenue from the fisheries sector is described in Box 10-1.

Box 10-1: Koo's Fishing Company

The major investment in the tuna fisheries sector is that of MIMRA's joint venture with Koo's Fishing Company of Taiwan. In 2006 the two entities created Marshall Islands Fishing Company to own and operate purse seine vessel(s) based in Marshall Islands. MIFCO purchased a used purse seine vessel from Koo's, with 49 percent and 51 percent shareholding by MIMRA and Koo's, respectively. MIMRA's equity purchase was funded through a loan from Koo's, to be paid back from MIMRA's share of profits. This loan to MIMRA has been completely repaid from vessel profits, according to the MIMRA Executive Director. According to the fiscal year 2013 government audit report, MIMRA netted US$2.7 million from the arrangement, and was one of only two of Marshall Islands' state-owned enterprises to have been profitable during the year.

Source: McCoy et al. (2015)

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 early 2008 the Economic Policy, Planning and Statistics Office carried out an employment survey in the country (EPPSO 2008b). The survey obtained data from social security records as well as from EPPSO non-reported estimates. The results of the survey that are relevant to the fisheries sector were extracted, and appear in Table 10-10.

Table 10-10: The Results of the EPSSO Employment Survey

Number of jobs	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Fishing	546	617	735	903	1,003	281	345	281
Total jobs in country	8,598	9,116	9,544	9,946	10,070	9,578	9,918	10,149
Total earnings (US$ millions/year)	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**
Fishing	1,374	1,448	1,563	1,731	1,986	830	1,053	889
Total all jobs in country	16,132	17,496	17,873	16,762	16,748	16,155	17,672	18,937
Average earnings (US$/year)	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**
Fishing	3,088	3,091	2,768	2,464	2,558	5,508	5,415	6,207
Total all jobs in country	8,539	8,479	8,479	8,340	8,791	9,474	9,654	9,544

Source: EPPSO (2008b)

Some observations can be made about the table:

- There is likely to be a significant number of people employed in fisheries jobs that do not make social security contributions.
- The decline in "fishing" employment between 2004 and 2005 suggests that "fishing" includes non-fishing jobs (e.g. those at the tuna loining plant that closed in late 2004).
- Assuming that the estimates in the table are accurate, in 2007 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 national average income level.

The FFA has tracked tuna-related employment in Marshall Islands. The total number of people employed (including "expat personnel and crews") in 2012 and 2013 is shown in Table 10-11.

Table 10-11: Employment in the Large Fisheries Companies

	2012	2013
Marshall Islands Fishing Venture (MIFV)	320	288
Koo's Fishing Company (KFC)	220	220
Pan Pacific Fisheries Inc. (PPF)	170	170
Total	**710**	**678**

Source: FFA (unpublished data)

An FFA report (McCoy et al. 2015) gives additional information about employment in these three companies (Box 10-2).

Box 10-2: Some Insight into the Industrial Fisheries Employment Situation

As of February 2015 the company Marshall Islands Fishing Venture reported employing a total of 180 Marshallese, with about 90 of those involved in the processing plant and the rest as dock workers and other support staff. Of the total, 99 percent of the workers were male; only 3 women worked in the processing plant. MIFV has hired a Marshallese human resources manager to try and assist with increasing employment of Marshallese onboard MIFV vessels. This is a fairly new initiative, and there has been limited success to date.

Koo's Fishing Company has had better results in hiring Marshallese for jobs onboard their purse seiners than the longliners.This may be due to the better working conditions onboard purse seiners and also to the practice of maintaining a roster that enables crew to rotate and not work on consecutive trips.

The Pan Pacific Fisheries experience with labor at their loining plant was described by the current and past managers as involving poor attendance and poor productivity. One full shift requires 400 workers, but the plant has rarely had that many on the job, with a good attendance being 140 workers.

There have been numerous explanations offered by government officials, fisheries experts and others regarding the labor problems in RMI, many of which are also problems in other PIC processing locations. In the case of Marshall Islands the situation is exacerbated because Marshallese may enter the US and work without a visa under the Compact of Free Association. This enables both skilled and unskilled workers to easily emigrate and find jobs in the US and likely affects motivation in the workplace.

Source: McCoy et al. (2015)

The 2011 census (EPPSO 2013) provides some information on fisheries-related employment in the country. In terms of the number of jobs, the census report combines fishing with agriculture, so the number of jobs given for "Skilled Agriculture and Fisheries Workers" (860) does not provide much insight into fisheries-related employment. However, the section on household activity is more useful:

> The second most popular agricultural activity is fishing. A total of 3,787 households reported fishing – that is 48.9 percent of total households in RMI. Again, fishing was primarily used for subsistence purposes - 64.1 percent of the households who went fishing claimed it was only for subsistence purposes, while 34.8 percent claimed that fishing was for both subsistence and income, and 1.1 percent reported it as a means of income.

Some further Marshall Islands fisheries-related employment facts are:

- SPC (2013) indicates that 75% of fishers are men and 25% are women.
- Rhodes et al. (2011) state that aquaculture employs about 40 Marshallese.
- Govan (2015) states that the government fisheries agency employs 90 people.

10.6 Levels of Fishery Resource Consumption

Discussions with Majuro-based nutrition and fisheries specialists indicate that there have been no general nutrition surveys in the last 15 years that involved fish consumption. Information on fish consumption must therefore come from older, general nutrition surveys, or from new studies focused on the fisheries sector.

With respect to older surveys:

- 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.
- Preston (2000), using 1995 FAO production, import, and export information, indicated the apparent per capita supply of fish in the Marshall Island was 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 percent 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.

With respect to more recent fishery-focused surveys:

- 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. 2009).
- 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).

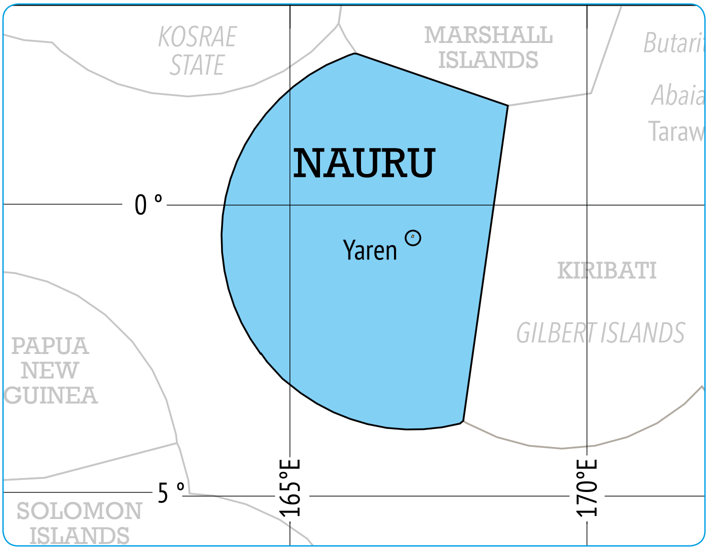
McCoy (2012) examined the "leakage" of fish from the major tuna transshipment ports in the Pacific Islands region. Very little leakage was found to exist in Majuro. Some fish are obtained by government officers during regular boarding, and according to agents some shore-side dock workers insist on being 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 a 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.

If Marshall Islands coastal fisheries production in 2014 of 4,500 mt (estimated by the present study) 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.

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 describe 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 mt, worth US$219,600; Commercial fisheries – 279 mt, 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 mt (worth A$514,250 [Australian dollars]), and an estimate of coastal subsistence production of 110 mt (worth A$1,732,500).

- 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 (CoFish 2005). The survey estimated that the annual catch of finfish was 589.4 mt[1], 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 mt, with all but some lobster catch used for home consumption.
- Gillett (2009) considered the above surveys, a 2006 HIES, the views of an expatriate fisheries adviser residing in Nauru, a report by an SPC fisheries specialist, a report by an 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."

A fisheries specialist who is familiar with the CoFish survey of Nauru and is a former resident of Nauru (T. Adams, per. com. November 2008) provided additional information on coastal fishery production in Nauru, as follows:

- The CoFish survey period was somewhat atypical. There was a fuel shortage at the time of the survey, so there were no outboard skiffs operating these skiffs are the boats that normally supply most of the catch of tuna and coastal pelagics.
- According to the 1999/2000 creel survey data (biased towards the boat-based fishery) published in the Nauru Fisheries and Marine Resources Authority's (NFMRA's) fisheries newsletter ("Mwinoañan"), the average landings per month of tuna alone were in the order of 2.5 mt (31 mt per year), with other (mainly pelagic) landings adding another 2 mt per month. However, this would be an underestimate, since monitoring was probably not 100%.

Since the 2009 study, above, there have been some changes that are likely to have affected coastal fisheries production in Nauru. A resident fisheries adviser points out several of these changes (B. Yeeting, per. com. January 2016):

- Unlike in 2005 when the ProcFish survey was done, there are now hardly any expatriate fishers (i.e. Kiribati and Tuvaluan). There are, at the most, three or four that go out fishing every day, except for Sunday.

1 Communication from SPC indicates that a revised estimate of total catch is 419.96 mt (M. Kronen, per. com. March 2009).

- Some phosphate money payouts started again in 2013. With that there has been a noticeable decrease in fishing activities, with more people falling back to the old habits of buying food from the shops. In 2012–13 there used to be up to 20 one-man canoes going out fishing on most days of the week, and these were operated mostly by Nauruans. In recent years the numbers have decreased to about six at the most, four of which are operated by men from Kiribati and Tuvalu.
- With the phosphate payouts, Nauruans are able to afford fuel, and those with boats are able to take their boats out again. The number of outboard motor boat owners that are going out has increased slightly compared to during the economic crisis, but there is still a large number of boats (about 40%) that are not able to go out because the engines have seized up after being left un-used during the period of the economic crisis.
- Fishing in general over the last three years has not been as good as in 2011 and 2012, so the annual production in 2014 is likely to have dropped slightly.
- A creel survey was carried out in 2012, but there is currently a lack of a multiplier that will allow the use of the results to obtain an estimate of annual production.

Also, with respect to recent changes in Nauru coastal fisheries, a survey was carried out in July 2010 by a researcher and NFMRA coastal fisheries staff. Perceptions about changes in Nauru coastal fisheries were obtained from 113 fishers. 78% of respondents stated that fishing costs more today, 6% stated that fishing costs less, another 4% stated that fishing costs are the same today compared to five years ago, while 12% were not sure. (Deiye 2015).

The Annual Report of the Nauru Fisheries and Marine Resources Authority (NFMRA 2015) provides information about coastal fisheries in Nauru (Box 11-1).

Box 11-1: Coastal Fisheries in Nauru

Nauru's artisanal fleet comprises of small (less than 6m) powered skiffs, canoes operated by local fishers. The powered boats are mostly used for trolling and often target pelagics. Other types of fishing include dropline fishing, gillnetting, cast-netting, angling, spearfishing by free diving or with scuba and reef gleaning targeting reef fish and invertebrates which are mainly for subsistence. Some commercial fishing activities are practiced but mostly on a part-time scale (99% of fishers), meaning that fish catches are sold only when there is surplus after meeting the subsistence needs. Apart from trolling and deep bottom drop-lining, the coastal fishing activities are generally conducted on the reef flats and the reef slopes.

Source: NFMRA (2015)

The preliminary results from the SPC-assisted monitoring of pelagic fishing by Nauru-based skiffs indicate an annual catch in recent years of about 144 mt (D. Brogan, per. com. August 2015). This differs markedly from information contained in the Nauru report to the Scientific Committee of the Western and Central Pacific Fisheries Commission (NFMRA 2015), which stated catches by the "Nauru artisanal fleet" were 524 mt in 2014.[2]

An informal survey of fish prices was undertaken in mid-2015. The results are given in Table 11-1.

Table 11-1: 2015 Retail Fish Prices in Nauru

Commodity	Selling unit	Unit price (A$)	Estimated price per kg
Small reef fish	Per string (30–50 fish)	$35	$8
Big reef fish	Per string (5–10 fish)	$50	$10
Tuna (to local people)	Per kg	$8	$8
Tuna (to Chinese restaurant)	Per piece depends on size (e.g. 5–6 kg)	$80	$14
Flying fish	Per piece	$1	
All fish (fish shop)	Per kg	$8	$8

Source: NFMRA (unpublished data)

SPC assisted in carrying out a household income and expenditure survey (HIES) in Nauru in 2012/2013. Unlike previous HIES work in Nauru and other Pacific Island countries, the 2012/2013 Nauru HIES was more fisheries-oriented, as described in the FSM section of this book. Staff of SPC's Statistics for Development Division kindly carried out some additional fisheries-oriented analysis on the HIES data. The results are given in Table 11-2.

Table 11-2: Coastal Fisheries Information from the 2013 Nauru HIES (A$)

	Cash expenditure	Non-cash expenditure	Total expenditure
Ocean fish	$948,533	$754,082	$1,702,616
Reef fish	$350,064	$397,275	$747,339
Invertebrates	$8,357	$26,477	$34,834
Total fresh, chilled or frozen fish and seafood	$1,306,955	$1,177,834	$2,484,789

Source: SPC (unpublished data)

2 This amount for the "Nauru artisanal fleet" is apparently based on the CoFish 2005 catch estimate of 589 mt, which includes all types of coastal fishing (including non-boat fishing).

Converting the expenditures in the table to volumes of fish carries many difficulties, especially in using appropriate prices. Nevertheless, doing so may give some insight into fish production. If a price of A$8 is assigned to all categories of commercial fish and A$5.60 to all categories of subsistence fish, then the HIES suggests commercial production of 163 mt and subsistence production of 210 mt (373 mt total).

Of the various types of information available, the HIES survey is judged to produce the best estimate of current coastal fisheries production in Nauru. The coastal commercial catch for 2014 is therefore estimated to be 163 mt, worth A$1,306,955 to fishers.

Coastal Subsistence Catches

Following the above approach, it is estimated that the production from coastal subsistence fisheries in Nauru in 2014 was 210 mt, worth A$1,177,834.

Locally Based Offshore Catches

There are currently no offshore fishing vessels operating from Nauru. The two longliners formerly owned by the Nauru Fisheries Trading Corporation (12 m and 15m) have not operated since the mid-2000s and have never been fully operational (Anon. 2008).

Foreign-Based Offshore Catches

The Nauru report to the Scientific Committee of the Western and Central Pacific Fisheries Commission (NFMRA 2015) states that, in 2014, Nauru licensed 226 purse seiners and 10 longliners to operate in its EEZ. In support of those fishing fleets, 15 tankers and 2 fish carriers were also licensed.

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries Commission have been made by the Forum Fisheries Agency, using data sourced from the Oceanic Fisheries Programme of SPC. The volumes and values can be determined using FFA (2015).

The volumes in FFA (2015) do not include bycatch, which is substantial for longlining. The values in FFA (2015) are overseas delivered values, which must be adjusted for transport costs to arrive at in-zone prices. Table 11-3 gives the adjusted volumes and values.

Table 11-3: Volumes and Values of Foreign-Based Offshore Fishing in the Nauru Zone

	2010	2011	2012	2013	2014
Purse seine volume (mt)	108,005	107,668	55,284	161,795	177,049
Longline volume adjusted for bycatch (mt)	107	204	267	204	332
Purse seine value adjusted for transshipment (US$)	123,115,606	162,190,510	103,413,243	291,792,481	229,312,252
Longline value adjusted for delivery costs and value of bycatch (US$)	685,847	1,485,884	1,653,598	1,063,250	1,887,746
Total offshore fishing volume (mt)	108,091	107,831	55,498	161,959	177,315
Total offshore fishing value (US$)	123,801,453	163,676,394	105,066,841	292,855,731	231,199,998

In 2014 the foreign-based offshore fishing produced 177,315 mt of fish, with an in-zone value of US$231.2 million (A$282.1 million).

Freshwater Catches

NFMRA (2005) states 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 just a few metres from the base of the escarpment. They range from about 40 m^2 to about 10,000 m^2 in area, either manufactured or naturally occurring. Anabar pond is the most significant, at 10,000 m^2. The ponds have become infested with tilapia, which is not popular as a food item.

In the present study any harvesting from these brackish-water bodies is considered to be aquaculture.

Aquaculture Harvests

NFMRA (2005) discusses the fall and rise of aquaculture in Nauru. Traditionally, juvenile milkfish were collected on the intertidal reef and reared in brackish ponds. The most important areas for farming were Buada Lagoon and, to a lesser extent, the Anabar pond. Farming was divided among families, with walls and fences, and the people had an intricate social fabric intertwined with milkfish culture. The Mozambique tilapia (*Oreochromis mossambicus*) was introduced around 1961, with assistance from the (then) South Pacific Commission, but it was not accepted as a food source, mainly because of its small size and poor flavour. Tilapia eventually infested all of the milkfish ponds and competed with the milkfish for food. The result was that milkfish harvested from infested ponds took longer to grow to an edible size, and this caused many farmers to abandon their traditional practice of raising milkfish. In 2000 the Buada Lagoon Owners Association introduced 10,000 milkfish fry from Kiribati into Buada Lagoon, reaping 5,000 adult fish some months later.

A resident fisheries adviser updated the situation (B. Yeeting, per. com. January 2016), as follows:

- There are currently 35 pond owners registered with the Nauru Fisheries and Marine Resources Authority (NFMRA). These are family-owned backyard milkfish ponds, and some are old swimming pools, in addition to the one-hectare Buada lagoon.
- Over the last few years milkfish farming has not been active, and only a couple of family-owned ponds are known to still have milkfish from the last fry shipment from Tarawa. These remaining milkfish were harvested during pond preparation work, yielding about 150 kg of milkfish.
- NFMRA is reviving milkfish farming, and has almost completed an aquaculture holding facility, which will be used to receive, hold and condition milkfish fry on a regular basis from Tarawa, before distributing/selling to local pond owners to stock their ponds. There are two extension officers helping people to prepare their ponds and they will provide assistance and advice to pond owners on stocking, feeding and management of the ponds.
- Currently there is no aquaculture production in Nauru.

Summary of Harvests

A crude approximation of the annual volumes and values[3] of the fishery and aquaculture harvests of Nauru in 2014 can be made from the above sections (Table 11-4).

3 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.

Table 11-4: Annual Fisheries and Aquaculture Harvest in Nauru, 2014

Harvest Sector	Volume (mt)	Value (A$)
Coastal Commercial	163	1,306,955
Coastal Subsistence	210	1,177,834
Offshore Locally based	0	0
Offshore Foreign-based	177,315	282,100,000
Freshwater	0	0
Aquaculture	0	0
Total	**177,688**	**284,584,789**

Figures 11-1 and 11-2 show the volumes and values of the 2014 Nauru fisheries production.

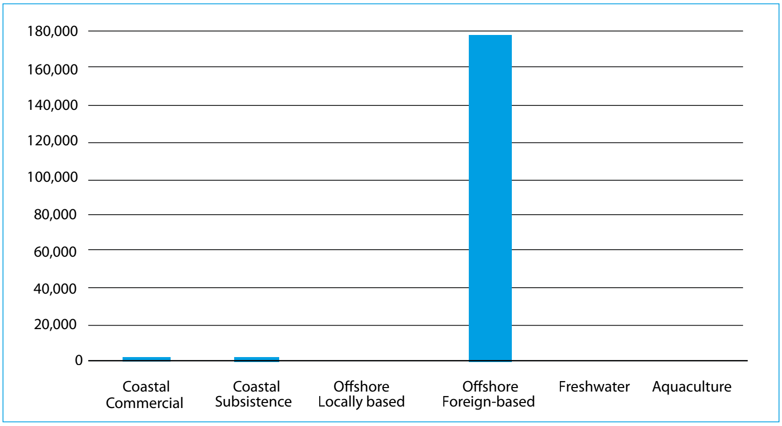


Figure 11-1: Nauru Fisheries Production by Volume (mt), 2014

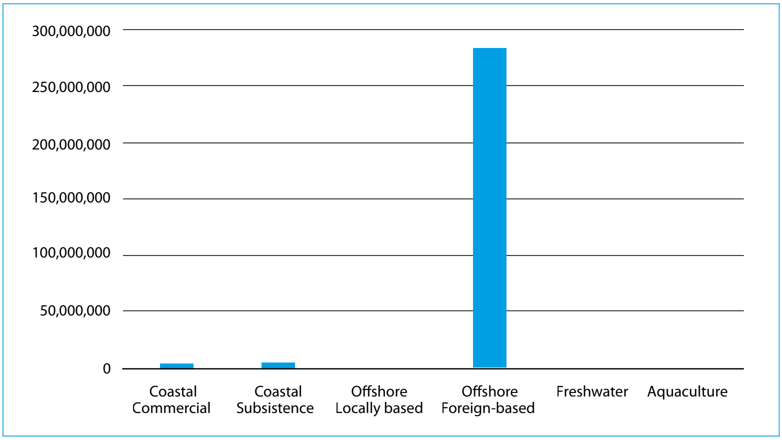


Figure 11-2: Nauru Fisheries Production by Value (A$), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for Nauru from those studies are provided in Table 11-5.[4]

Table 11-5: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, and pcs where indicated)	Nominal Value (A$)
Coastal Commercial	1999	315	1,732,500
	2007	200	1,000,000
	2014	163	1,306,955
Coastal Subsistence	1999	110	514,250
	2007	450	787,000
	2014	210	1,177,834
Offshore Locally based	1999	50	387,000
	2007	0	0
	2014	0	0
Offshore Foreign-based	1999	41,000	57,000,000
	2007	69,236	95,201,620
	2014	177,315	282,100,000
Freshwater	1999	n/a	n/a
	2007	0	0
	2014	0	0
Aquaculture	1999	n/a	n/a
	2007	8	18,000
	2014	0	0

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

The apparent changes in production for the three-year period represents a real change in production in some cases, but this can also represent a change in the methodology for measuring the production (hopefully an improvement), or the availability of new information. In the table above, the production levels for coastal commercial and coastal subsistence change

4 The earliest Benefish Study, Gillett and Lightfoot (2001), did not include aquaculture, freshwater fisheries or the non-independent territories.

significantly between the years, but some of that change is due to the way in which the production was estimated. For example, in the period between making the 2007 and 2014 estimates in the table, information from the 2012/2013 HIES (thought to be reasonably accurate) became available. In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better quality data) are likely to 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 "fisheries" contribution to GDP, is given in Table 11-6.

Table 11-6: Fisheries Contribution to Nauru's GDP

	FY2010	FY2011	FY2012	FY2013	FY2014
Fisheries contribution to GDP (millions of A$)	2.1	2.2	2.2	2.3	3.2
GDP at current prices (millions of A$)	51.3	76.5	96.5	111.5	142.1
Fisheries as a % of GDP	4.1%	2.9%	2.3%	2.1%	2.3%

Source: Department of Finance and Economic Planning

Method Used to Calculate the Fisheries Contribution to GDP

ADB (2007) states that compiling GDP estimates for Nauru is complicated by a number of special factors. These include pending salaries, Bank of Nauru checks, the treatment of the Refugee Processing Centre, large subsidies to government-owned business enterprises, large numbers of redundancies in the public sector, and gaps in the statistical collection.

The brief general explanation in ADB (2007) is the only available explanation of the GDP calculations: "GDP estimates have been compiled by industry using a mixture of the income and production approaches. Using the income approach, GDP is equal to compensation of employees plus gross operating surplus plus taxes on production and imports less subsidies. Using the production approach, GDP is equal to output less intermediate consumption."

Alternative Estimate of Fishing Contribution to GDP

Table 11-7, 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 11-4), 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 11-7 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 11-7: Fishing Contribution to GDP Mid-2000s Using an Alternative Approach

Harvest Sector	Gross Value of Production (A$, from Table 11-4)	VAR	Value Added (A$)
Coastal Commercial	1,306,955	0.60	784,173
Coastal Subsistence	1,177,834	0.90	1,060,051
Offshore locally based	0	--	0
Freshwater	0	--	0
Aquaculture	0	--	0
Total (A$)	**2,484,789**	**--**	**1,844,224**

The 2014 fishing contribution to GDP in the table (A$1.8 million) is considerably less than the official fisheries contribution of A$3.2 million (given in Table 11-6). Given the lack of details available on the official methodology it is difficult to speculate about why the difference is so great, other than simply stating that, if the official estimate used the production approach to estimate the fisheries sector contribution, the volume production from coastal fisheries in the two studies must be very different.

11.3 Exports of Fishery Production

Currently, there are no formal exports of fishery products from Nauru. The last export shipment of fresh tuna from the domestic longline operation was in 2001, and only seven shipments were ever made. Although the fish was of good quality and received a good price at auction in Japan, the local longline operation was unprofitable for various reasons, including frequent mechanical problems and non-incentivised wage structures (Philipson 2007).

Informal exports of fish are made by passengers travelling on regular commercial flights. These shipments are often for family and friends in Australia, Fiji and Marshall Islands.[5] Although the Nauru Quarantine Office issues certificates for fish and other marine products that are being taken out of the country, to ensure that the products are in good condition, those certificates do not indicate the weights of the shipped products.

11.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

Nauru government budget papers list the following foreign fishing access fees:

- FY 2013: A$10.01 million
- FY 2014: A$19.34 million

ADB (2014) estimates that "revenue and grants" received by the Nauru government for FY 2013 were A$110.9 million, and for FY2014 were A$141.4 million. Access fees therefore represented 9.0% of revenue/grants in FY2013, and 13.7% in FY 2014.

Other Government Revenue from Fisheries

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

11.5 Fisheries-Related Employment

In the early 2000s Nauru experienced an economic crisis that had a profound effect on employment, including fisheries-related employment. Some information on the crisis is given in Box 11-1.

5 In the present study fisheries officials in Marshall Islands report that a significant amount of "oily trevally" are shipped from Nauru to Majuro (G. Joseph, per. com. September 2015).

Box 11-1: The Impacts of the Nauru Economic Crisis on Fisheries

With respect to recent changes in the fisheries employment situation, CoFish (2005) states that due to the economic crisis at the beginning of the decade, there has been a dramatic increase in reef fishing, gleaning and collecting. Dame (2006) gives some insight into another changing aspect of fisheries employment in Nauru. Fishing activity among Nauruans is likely to increase following the repatriation of I-Kiribati and Tuvaluan expatriate workers. Previously, following the winding down of mining operations, most fishing activity was carried out by I-Kiribati and Tuvaluan nationals. Generally, speaking Nauruans and other nationals normally bought fish from the I-Kiribati and Tuvalu fishermen and garden fresh produce from Chinese but with the repatriation of I-Kiribati and Tuvaluan workers and with increasing numbers of Chinese nationals also leaving the island, this is changing. Nauruans can no longer depend on expatriate workers to supply fish and garden produce and now Nauruans themselves are going out to gather the supplies from traditional work such as, fishing etc.

Source: CoFish (2005)

CoFish (2005) provides the results of fisheries-focused socio-economic surveys carried out in 11 of the 14 districts in Nauru in October and November 2005:

- The total resident population at the time was estimated to be 10,131 people, with 1230 households.
- 245 households were surveyed for income and expenditure, with 97% of these found to be engaged in fishing activities.
- 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 results of the Nauru 2011 census (Anon. 2012) provide some insight into participation in fishing, as follows:

- The main source of household income was, for 85% of all households, wages and/or salary. Seven percent of households' main income 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 between Nauru's 14 districts. Only 21% of the households in Nibok District were involved with fishing, while 96% of the households in Ijuw District were involved with fishing.
- Aquaculture was undertaken by only 2% of all households in Nauru, and this was entirely for subsistence. Aquaculture was mainly undertaken by households in Ewa District.

A baseline survey on the role of women in fisheries in Nauru was carried out in November 1997. The survey was conducted by Patricia Tuara (Women's Fisheries Development Officer at SPC), with the assistance of Julie Olsson (Director of Culture and Tourism, Ministry of Internal Affairs). The assessment was requested by the Government of Nauru in response to a felt need for information concerning the participation of Nauruan women in the fisheries sector. A summary of the results appears in Box 11-2.

Box 11-2: The Role of Women in Nauru Fisheries

The participation of women in fisheries activities differs depending on the ethnic background of the woman. The three main ethnic groups involved in fisheries are Nauruan women, I-Kiribati women and Chinese women. Nauruan women are mainly involved in the harvesting of resources, with less involvement in processing and marketing. I-Kiribati women are involved in harvesting, processing, and marketing of resources. Chinese women are involved in the marketing of resources. ii) Apart from the constraints imposed by society, the main restriction on women's participation in fisheries is competition for limited reef resources leading to over-exploitation. iii) Women involved in fisheries are unaware of support services available to them. iv) Government fisheries development has focused on projects that support the activities of fishermen and exclude fisherwomen. v) There are a lack of women undertaking formal marine studies and employed in technical positions in the marine public sector.

Source: Tuara (1998)

SPC (2013) uses data from its ProcFish programme to examine the ratio of men to women fishers across the Pacific. For Nauru, about 65% of fishers were men and 35% were women.

The results of the 2012/2013 Household Income and Expenditure Survey (Nauru Bureau of Statistics, 2014) contains some information on participation in fishing, as follows:

- The total resident Nauru population in 2012 was estimated to be 10,293, with 1,705 private households, over the 14 districts of Nauru.
- It was estimated that 26% of the households were engaged in fishing.
- About 8.94% of the Nauruan Labour force of 3,952 was involved in some form of fishing. This relates 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. This equates to about 50 fishers.
- With regard to part-time commercial fishers, if this is taken as those who have fishing as a secondary activity, about 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 2012/2013 HIES. The census indicates that just over half (51%) of all households in Nauru were engaged in fishing activities. The HIES estimated that 26% of the households were engaged in fishing.

The NFMRA is a significant employer. It has 25 staff involved with coastal fisheries, 5 in oceanic fisheries, 13 in corporate services and a Chief Executive Officer, for a total of 44 staff. (B. Yeeting, per. com. January 2016).

11.6 Levels of Fishery Resource Consumption

Gillett and Lightfoot (2001) considered estimates of fisheries production, population and imports of fishery products, to arrive at an annual per capita consumption of fishery products on Nauru of 46.7 kg in the late 1990s. According to many studies, the consumption of fishery products in Nauru has changed considerably since the period covered by that study.

The SPC/CoFish study in Nauru in October and November 2005 examined the consumption of fishery products. Per capita consumption of fresh fish was recorded at being 46.5 kg/year. Finfish is consumed at an average of 3.8 times per week, while invertebrate consumption is much lower, with a frequency of about twice a month. Canned fish is also frequently consumed, averaging 2.4 times per week for most households, and annual per capita consumption at about 16 kg, which is considerable, but is only about one-third of finfish consumption. For many families canned fish is an affordable substitute and can be cooked as soup and in many other ways to feed large families. The low consumption of invertebrates could be due to their over-harvesting. There is very high reliance on fresh fish, with many households interviewed consuming their own catches or buying fish from, or being given fish, by relatives and neighbours. The results of the CoFish survey with respect to fish consumption are summarised in Table 11-8.

Table 11-8: Consumption of Fishery Products on Nauru According to the SPC/CoFish Survey

Aspect (units)	Measure
Quantity fresh fish consumed (kg/capita/year)	46.45 (±2.74)
Frequency fresh fish consumed (time/week)	3.79 (±0.14)
Quantity fresh invertebrate consumed (kg/capita/year)	1.63 (±0.19)
Frequency fresh invertebrate consumed (time/week)	0.53 (±0.04)
Quantity canned fish consumed (kg/capita/year)	15.86 (±1.12)
Frequency canned fish consumed (time/week)	2.42 (±0.12)

Source: CoFish (2005)
245 households surveyed

Bell et al. (2009) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both subsistence and cash acquisitions. For the whole of the Nauru the annual per capita fish consumption (whole weight equivalent) was 55.8 kg, of which 96% was fresh fish.

Two different studies have covered per capita catch rates for Nauru:

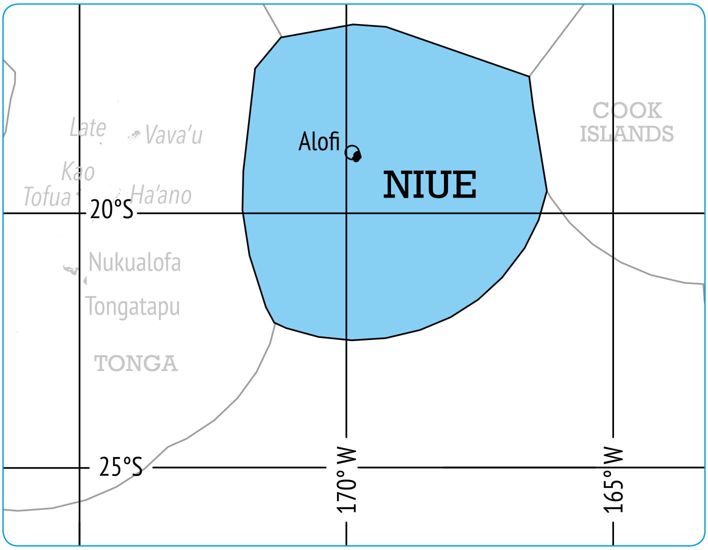
- Dalzell and Debao (1994) estimated a 1991 per capita catch rate of 45 kg per person per year.
- The present study estimates a 2014 coastal fisheries catch rate of 35.0 kg per person per year (i.e. 373,000 kg; 10,660 people)

11.7 Exchange Rates

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

2007	2008	2009	2010	2011	2012	2013	2014
1.19	1.10	1.12	0.10	0.98	0.96	1.12	1.22

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:

- McCoy (1990) estimates the total fisheries production to be 100–150 mt, half of which comes “from the reef” and half from “beyond the reef.”
- Dalzell et al. (1993), using information from an SPC nutrition survey carried out in Niue in 1978, estimate the total catch to be about 115 mt per year, with an additional 4.9 mt per year exported to New Zealand during periods of direct air connections.
- Dalzell et al. (1996), using reference material from 1990, estimate that the annual production from the subsistence fisheries was 103 mt, worth

US$471,504 (or about NZ$7.64 per kg), and the production from the commercial fisheries was 12 mt, worth US$54,720.

- The Niue Department of Agriculture, Forestry and Fisheries has historically used the figure of 120 mt as the production from all Niue fisheries.
- During the work done in compiling the national accounts, a survey of 20 households (3.6% of all households on Niue) was carried out in June 2000. The results of the survey indicated that the annual catch from the subsistence fisheries was about 194 mt, worth NZ$315,640. (Lewington 2000).
- Gillett and Lightfoot (2001) considered the results of the studies above, and other information, and ventured an estimate of a coastal commercial catch of 12 mt (worth NZ$96,000), and a coastal subsistence catch of 194 mt (worth NZ$315,640).
- The SPC ProcFish programme surveyed Niue in June 2005. As part of that work estimates were made of the annual production in various categories of fishing. The report of the survey (Kronen et al. 2008) states: (a) the survey data suggests a total annual reef finfish catch of 53.4 mt., (b) there is an estimated production of 76.2 t/year from mid-water and trolling fishing, (c) applying sample data to the total number of possible invertebrate fishers in Niue, the total annual impact in biomass (wet weight) removed amounts to 35.3 t/year. This equates to a total annual harvest of 164.9 mt.
- Gillett (2009) considered all of the above studies (except the ProcFish work, as the results were not available), recent information on factors that could affect coastal fishery production, recent surveys, and current prices of fish. Coastal fisheries production in 2007 was estimated to be 150 mt, comprising commercial production of 10 mt (worth NZ$80,000 to fishers) and subsistence production of 140 mt (worth NZ$840,000).

According to Niue fisheries officials, estimates of total fisheries production for coastal fisheries have not been made in Niue since 2008. In examining the above studies it appears that the ProcFish work was the most methodical in the way that coastal fisheries production was estimated. The approach followed in the present study is to assume that the ProcFish estimate is reasonably accurate, and to adjust it by factors that are likely to have affected production in the period since that estimate was made.

In recent years there have been some changes that could have affected coastal fisheries production. According to an individual knowledgeable in Niue fisheries (J. Tamate, per. com. December 2015), these include the following:

- The locally based longliners ceased operations in late 2007. When those vessels operated from Niue (2005–2007) there was an increase in the supply of fish (i.e. sales of longline bycatch), resulting in lower-priced coastal fish. When the operations ceased in late 2007 the price increased.
- To compensate coastal fishers for the lower prices for coastal fish due to the longlining, the government introduced a fuel subsidy in 2006 to ensure local fishers would remain in the fishery. The subsidy was removed in late 2015.
- In the period 2007 to 2014 the population of Niue dropped from 1,587 to 1,499, representing a reduction of 5.9% (SPC's PRISM website information).
- Major cyclones have had substantial negative impacts on coastal fisheries. The last serious cyclone to hit Niue was cyclone Heta in 2004.
- The number of fish aggregation devices has been relatively constant in the last decade.
- An international fishing competition was started in 2010.
- There was an increase in the number of canoes and fishing activities from 2010. In 2014 one village launched 40 new canoes.
- Average prices paid to fishers increased, from NZ$7 to NZ$9 per kg in 2007, to NZ$12–15 in 2014.

The above list of factors suggests there are influences that would tend to both increase and decrease coastal fisheries production, with no remarkable net affect. This is consistent with information supplied by Niue fisheries officials, who believe that production has not changed much since the 2005 ProcFish work.

Using the above information selectively, it is estimated that the coastal fisheries production in Niue in 2014 was 165 mt, made up of 11 mt of commercial catch (worth NZ$148,500 to fishers) and 154 mt of subsistence catch (worth NZ$1,455,300 to fishers).

Coastal Subsistence Catches

Following the above approach, the coastal subsistence fish catch in Niue in 2014 is estimated to be 154 mt. Using the farm gate system of valuing subsistence production (discounting prices for commercial fish by 30%), this would be worth NZ$1,455,300 to fishers.

Locally Based Offshore Catches

Tafatu (2006) states 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 Niue's Department of Agriculture, Forestry and Fisheries indicates that production from the boats reached a maximum in 2006 and early 2007. Fishing operations stopped in December 2007. (B. Pasisi, per. com. December 2008).

There has been no locally based offshore fishing in Niue since 2007. The one small "alia" catamaran longliner operating since 2013 is considered to be part of the coastal fleet for the purposes of the present study.

Foreign-Based Offshore Catches

Fisheries Division (2015) states:

> A total of five out of eight vessels that were licensed to fish in 2014 engaged in fishing. These vessels were flagged to Fiji, Cook Islands, United States and Taiwan. As expected, albacore made up the majority of the catches, followed by yellowfin and bigeye. The effort is slightly lower in 2014 compared to 2013 and it was concentrated on the north western part of the island.

US purse seine 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.

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries Commission (WCPFC) area have been made by the Forum Fisheries Agency using data sourced from the Oceanic Fisheries Programme of the Pacific Community. The volumes and values can be determined using FFA (2015).

Table 12-1, below, adjusts those volumes for bycatch. The values in the table are adjusted: (a) to account for the value of the bycatch, and (b) to be in-zone values (i.e. overseas market prices, less transport charges to those markets).

Table 12-1: Foreign-Based Offshore Catches in the Niue Zone

	2010	2011	2012	2013	2014
Adjusted catch volume (mt)	322	0	0	597	547
Adjusted catch value adjusted (US$)	718,540	0	0	1,306,626	1,519,487

Source: FFA (2015)

It can be seen from the table that the 2014 foreign based offshore catch in the Niue zone was 547 mt of tuna and bycatch, with an in-zone value of US$1,519,487 (NZ$1,944,943).

Freshwater Catches

There are no freshwater fisheries in Niue. The Director of Niue's Department of Agriculture, Forestry and Fisheries (B. Pasisi, per. com. December 2008) indicates that neither tilapia nor Macrobrachium are caught in Niue.

Aquaculture Harvests

There is no aquaculture activity on Niue. Although there has been enthusiasm for culturing a number of species (trochus, giant clams, pearl oysters and freshwater prawns) in the past, these plans have not been realised.

Summary of Harvests

A crude approximation of the annual volumes and values[1] of the fishery and aquaculture harvests in 2014 can be made from the above sections (Table 12-2).

Table 12-2: Annual Fisheries and Aquaculture Harvest in Niue, 2014

Harvest Sector	Volume (mt)	Value (NZ$)
Coastal Commercial	11	148,500
Coastal Subsistence	154	1,455,300
Offshore Locally based	0	0
Offshore Foreign-based	547	1,944,943
Freshwater	0	0
Aquaculture	0	0
Total	**712**	**3,548,743**

1 The values in the table are dockside/farm gate prices.

Figures 12-1 and 12-2 show the volumes and values of the 2014 Niue fisheries production.

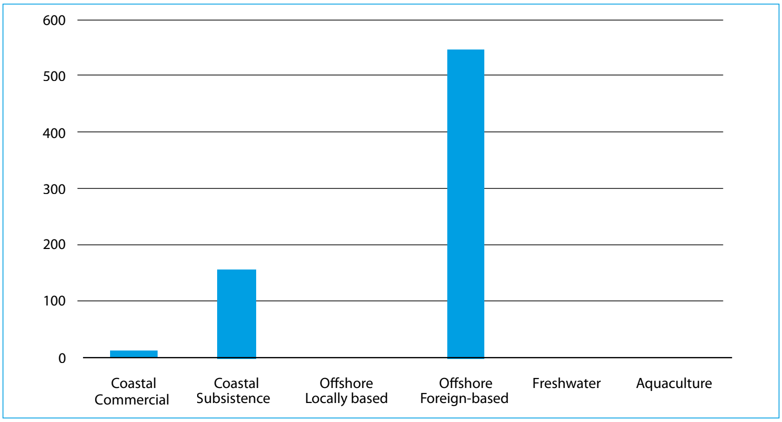


Figure 12-1: Niue Fisheries Production by Volume (mt), 2014

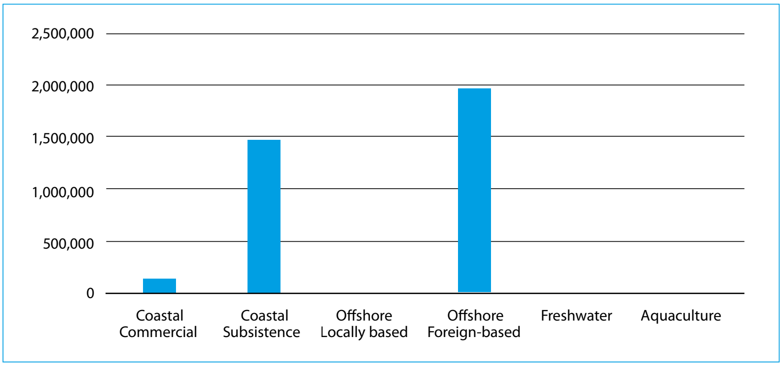


Figure 12-2: Niue Fisheries Production by Value (NZ$), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007 and the present study focuses on 2014. The fishery production levels for Niue from those three studies are presented in Table 12-3.[2]

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

Table 12-3: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, and pcs where indicated)	Nominal Value (NZ$)
Coastal Commercial	1999	12	96,000
	2007	10	80,000
	2014	11	148,500
Coastal Subsistence	1999	194	315,640
	2007	140	840,000
	2014	154	1,455,300
Offshore Locally based	1999	0	0
	2007	640	2,508,000
	2014	0	0
Offshore Foreign-based	1999	2	8,000
	2007	0	0
	2014	547	1,944,943
Freshwater	1999	n/a	n/a
	2007	0	0
	2014	0	0
Aquaculture	1999	n/a	n/a
	2007	0	0
	2014	0	0

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

The apparent changes in production for the three-year period represents a real change in production in some cases, but this can also represent a change in the methodology for measuring the 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, in 2002 a household income and expenditure survey (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) are likely to reflect real changes in the amounts being harvested.

12.2 Contribution of Fishing to GDP

Current Official Contribution

The Niue GDP for recent years is given in Statistics and Immigration Division (2015). Unpublished data from the Statistics and Immigration Division gives the fishing components of the GDP. These are shown in Table 12-4. According to the Director General of Natural Resources, the category "private (fisheries)" is commercial fishing, and the category "Private and subsistence" is fishing by people for subsistence and occasional sales.

Table 12-4: The Fisheries Contribution to the Niue GDP (NZ$ thousands)

	2008	2009	2010	2011	2012	2013	2014
Private (fisheries)	86	106	115	118	121	122	125
Private and subsistence	839	1,032	1,117	1,152	1,180	1,188	1,212
Total fisheries	925	1,138	1,232	1,271	1,301	1,310	1,337
Niue GDP (current prices)	21,417	22,858	25,073	26,970	28,125	30,381	31,273
Fisheries as a % of GDP	4.3%	5.0%	4.9%	4.7%	4.6%	4.3%	4.3%

Source: Statistics and Immigration Division (2015), and Statistics and Immigration Division (unpublished data)

Method Used to Calculate the Official Fishing Contribution to GDP

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 12-5, 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 12-2), 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 12-5 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 12-5: Fishing Contribution to GDP 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production (NZ$, from Table 12-2)	VAR	Value Added (NZ$)
Coastal Commercial	148,500	0.65	96,525
Coastal Subsistence	1,455,300	0.85	1,237,005
Offshore locally based	0	0.20	0
Freshwater	0	0	0
Aquaculture	0	0	0
Total (NZ$)	**1,603,800**	---	**1,333,530**

The above 2014 fishing contribution of NZ$1,333,530 represents 4.3% of the NZ$31,273,000 GDP of Niue. This is remarkably close to the official contribution of NZ$1,337,000, which is also (with rounding) 4.3% of the GDP.

12.3 Exports of Fishery Production

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 occur as passenger baggage on flights to Auckland, but these are not monitored.

If there were 75 flights in 2014 and each flight carried 100 kg of fish, this equates to an informal export of 7.5 mt of fish during the year. In 2014 the value of all exports was NZ$19,309,000 (http://wits.worldbank.org), so at NZ$15/kg this hypothetical fish export represented about 0.6% of all exports in 2014.

12.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

The Niue report presented in August 2015 to the Scientific Committee of the Western and Central Pacific Fisheries Commission (Fisheries Division 2015) states that, in 2014, eight vessels were licensed to fish in the Niue zone. According to the Director General of Natural Resources, each vessel paid

US$10,000 (a total of NZ$102,400 for eight vessels) to fish in the Niue zone (J. Tamate, per. com. November 2015).

Under the terms of the US multilateral tuna treaty, Niue and other Pacific Island countries receive payments from the US government and the US tuna industry, which are associated with fishing access by US purse seine vessels. Although US purse seiners have not attempted to fish in Niue in over 20 years, Niue still receives these payments. According to unpublished data from the US National Fisheries Service and from the Forum Fisheries Agency, in 2014 Niue received US$555,815 (NZ$711,443) for participation in the tuna treaty.

In 2014 the total access fees for the longlining and the US treaty were NZ$813,843. In the government budget this is split between two fiscal years. In “Estimates of Expenditure and Revenue for 2014/15” (Government of Niue 2015), the actual revenue was NZ$777,449 in fiscal year 2013/2014 and NZ$979,000 in fiscal year 2014/2015.

According to the Appropriations (Annual) Act 2014, the 2013/2014 actual “recurrent expenditure” was NZ$24,359,389. The NZ$813,843 paid for fishing access in 2014 (eight vessels plus the US tuna treaty) therefore represents 3.3% of the government’s recurrent expenditure for Niue’s budget year 2013/2014.

Other Government Revenue from Fisheries

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

12.5 Fisheries-Related Employment

The 2009 agriculture census of Niue (Statistics Niue 2010) contains fisheries participation information, as follows:

- Most household were engaged in inshore fishing (62%), 31% were involved in both inshore and offshore fishing, with the remaining 7% being involved in offshore fishing only. This showed that fishing in Niue is still more of a subsistence activity than commercial fishing.
- Household participation in fishing activity was very high across the country, with only one village (Lakepa) with less than a 50% participation rate. Toi had the highest participation rate (89%), where 8 out of 9 household were involved in fishing in the last 10 months.

- The main purpose of household fishing activity was for home consumption, accounting for 82% of fishing households, with 16% selling some of their catches, with the remaining 2% of fishing households fishing mainly for the purpose of sale.
- Of the 564 people who engaged in fishing in the week before the census night, 201 were females and 363 were males.

Employment was covered in the 2011 Niue census (Vaha, 2012). Unfortunately, this census information is not very useful for the fishing sector because it aggregates fishing jobs into a larger category: "Skilled agricultural forestry and fishery workers". The census listed 737 people in the labour force, of which 50 were "Skilled agricultural forestry and fishery workers".

To some degree in Niue, the change in the number of boats reflects the change in participation in fishing. A comparison of the number of vessels in the 2006 and 2011 censuses (Anon. 2007 and Vaha 2012) is given in Table 12-6. It can be seen in the table that, between 2006 and 2011, the population of small craft increased by 57 (26%), while the national census shows that the human population decreased by 14 people (0.9%).

Table 12-6: Change in the Number of Small Craft 2006–2011

	Canoe	Aluminium Dinghy	Inflatable Dinghy	Boat	Other	Total
2006	122	66	5	23	0	216
2011	142	115			16	273

Source: Anon. (2007) and Vaha (2012)

The SPC ProcFish survey in 2005 (Kronen et al. 2008) contained some useful employment information, as follows:

- There are estimated to be 597 fishers (346 males and 251 females). Of these, 170 persons fish only for finfish (155 males, 15 females), 75 only harvest invertebrates (13 males, 62 females), and 352 fish for both finfish and invertebrates (178 males, 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% gain a secondary income from selling agricultural produce).

Three reports provide information on gender aspects of Niue fishing:

- Tuara (2000) states that there is little to no information documenting the activities of women involved in fisheries in Niue. The report indicates that females are involved in a range of reef fishing activities. During the day, when the tide is low, females collect a range of invertebrates, including octopus, Turbo spp. snails, tube worms, sea urchins, clams, seaweed and other shellfish. Most of these are collected by hand, although metal implements are sometimes used to dislodge shellfish from the rocks. Females also use poles with a piece of monofilament line and a hook to fish for reef fish in rock pools at the reef edge.
- Vunisea (2005) states that women fish within the narrow reef areas, while men fish from canoes, dinghies and powered boats beyond the reef. Women's fishing activities involve gleaning for shellfish, collecting crabs and other seafood, and using rods and line to catch reef fish along the reef edges. Men mainly troll for pelagic fish, especially the migratory tuna species. The installation of fish aggregating devices has helped to extend men's fishing activities beyond the immediate reef areas.
- Kronen et al. (2008) provide information on the areas where men and women characteristically fish (Table12-7).

Table 12-7: Gender Aspects of Fishery Resources and Fishing Areas

Resource	Fishery	% Male fishers interviewed	% Female fishers interviewed
Finfish	Coastal reef slope	100	100
Invertebrates	Coastal reef flat	98.4	100
	Other	1.6	0

A Niue-based fisheries economist believes 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 (J. Tamate, per. com. December 2015). Those 10 people represent about 1.4% of Niue's 737 person work force.

12.6 Levels of Fishery Resource Consumption

Dalzell et al. (1993) estimated per capita fish consumption using a 1987 SPC nutrition study. It is estimated that annual per capita consumption is 40.8 kg food weight, or about 49.0 kg whole fish weight.

Gillett and Lightfoot (2001) considered: (i) the Niue population of 1,900 people in 2000; (ii) subsistence fisheries production of 194 mt; (iii) commercial fisheries production of 12 mt; and (iv) fishery imports of 20 mt. From this information they determine that the annual per capita consumption of fishery products on Niue in 2000 was about 118.9 kg.

SPC's ProcFish programme conducted fieldwork around Niue in May and June 2005. With respect to fish consumption, that survey interviewed about half of the households and made estimates of fish consumption (Table 12-8).

Table 12-8: Seafood Consumption on Niue, from SPC's ProcFish Survey

Item	Consumption (kg)
Quantity fresh fish consumed (kg/capita/year)	31.03 (±2.28)
Quantity fresh invertebrate consumed (kg/capita/year)	2.53 (±0.33)
Quantity canned fish consumed (kg/capita/year)	17.17 (±1.26)

Source: Kronen et al. (2008), and M. Kronen per. com. (March 2009)

The report of the Niue ProcFish survey (Kronen et al. 2008) reveals some interesting results concerning the nature, frequency and quantity of seafood consumption:

> Taking into account all households interviewed, the per capita consumption of fresh fish was found to be 31.1 kg/year on average. This figure is below the regional average estimated at 35 kg/ year and also lower than previous estimates, which range from 40.8 to 49 kg/year (Dalzell et al. 1993) to 118.9 kg/year (SPC 2000). However, it should be noted that the data we collected only cover the average household consumption and do not include finfish consumed at frequent feasts and celebrations, such as haircutting ceremonies, or in meals purchased from snacks and restaurants, which is likely to be a substantial amount. An estimation of this increment is made by adding pelagic and mid-water catch data reported in the framework of the SPC project on FADs to our reef and canoe fishing data. Variation in finfish consumption among villages, however, is significant. Consumption ranges from 7.8 kg/year (Namakulu) to 49 kg/year (Alofi

> North). Comparing the geographic location of villages where fresh fish consumption is high, such as Avatele, Tamakautoga and Alofi, with those where consumption is much lower, higher consumption appears to coincide with easier access to less exposed fishing grounds. The average per capita canned fish consumption of 18.2 kg/year is relatively high but not surprising given the high dependency on imported goods and the fact that fish constitutes a traditional and integral component of the Niuean diet.

The results of the ProcFish study, in respect of commercial fishing, are described in the present chapter, above. The following further observations may be made: (a) the survey data suggests a total annual reef finfish catch of 53.4 mt; (b) there is an estimated production of 76.2 t/year from mid-water and trolling fishing; (c) applying sample data to the total number of possible invertebrate fishers in Niue, the total annual impact in biomass (wet weight) removed amounts to 35.3 t/year. This equates to a total annual harvest of 164.9 mt in 2005. Subtracting the informal exports of fish (7.5 mt per year from the export section above) gives 157.4 mt. With Niue's 2005 population of 1,660, that equates to 94.8 kg per capita. Adding 17.2 kg of canned fish, from the table above, results in 2005 annual per capita fish consumption in Niue of 112.0 kg.

Bell et al. (2009) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both subsistence and cash acquisitions. For Niue the annual per capita fish consumption (whole weight equivalent) was 79.3 kg, some of which was imported.

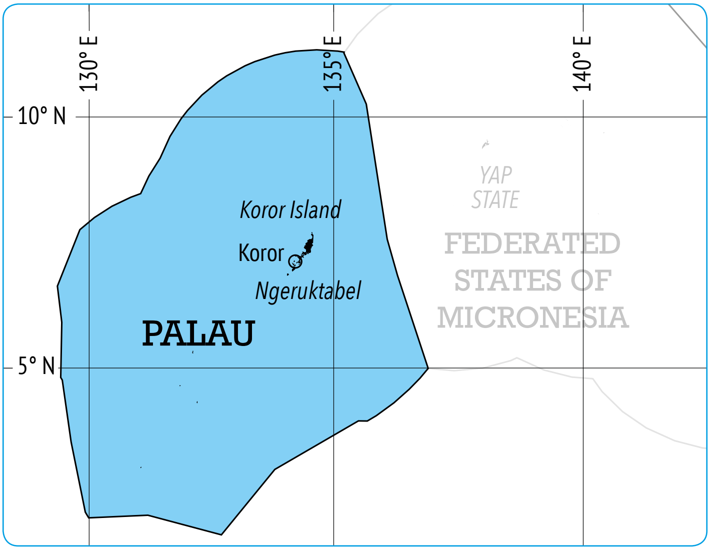
In the present survey production from coastal commercial and subsistence fisheries is estimated to have been 165 mt in 2014. The population of Niue was 1,499 in 2014 (SPC's PRISM website data). That equates to 110 kg per capita per year, without considering informal fish exports and canned fish imports.

12.7 Exchange Rates

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

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.51	1.42	1.54	1.36	1.32	1.39	1.30	1.29	1.21	1.22	1.28

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 mt.
- Kitalong and Dalzell (1994) examine 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 mt (worth US$2.4 million), and subsistence production of 750 mt (worth US$1.8 million).
- PCS (2000) examined all available information on the amount of inshore catch in Palau for the years 1989 to 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 to 1998 was 2,115 mt.
- Gillett and Lightfoot (2001) decided that the above PCS (2000) estimate was the most accurate available, and partitioned that estimate into coastal commercial and subsistence components of 865 mt (worth US$2,595,000) and 1,250 mt (worth US$2,500,000), respectively.
- Gillett (2009) considered the above studies, as well as some more recent information: (a) the results of the 2006 household income and expenditure survey, (b) some fisheries-focused surveys, (c) changes in production indicated by the surveys of some of the markets, (d) the views of fisheries specialists with long involvement in Palau fisheries, and (e) factors that may have influenced fishery production levels in recent years. Gillett (2009) concluded that: (1) there is a general consensus on the validity of the PCS survey, and (2) 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 mt (with a value of US$2,843,000 to fishers), and the volume of subsistence coastal production was 1,250 mt (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 mt 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 the 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 /yr (2001-2009)."

Since the above estimates were put forward there have been a number of changes that could have had major impacts on coastal fisheries production in Palau. Discussions with fishery stakeholders show the following were especially significant:

- Tourism has expanded substantially. Graduate School (2015) indicates that the number of visitors to Palau has increased from 87,141 in 2007 to 125,417 in 2014.
- In the past five years there have been periodic bans on the capture of certain fish species (e.g. groupers). (N. Idechong, per. com. September 2015)
- Because of the Helen Reef Management Project, there is much less fish arriving in Koror from the Southwest Islands. (A. Kitalong, per. com. September 2015)
- Two typhoons were especially destructive: Bopha in December 2012 and Haiyan in November 2013.
- There has been a decrease in the price of fuel since the 2008 peak.
- A number of studies have indicated a general decrease in abundance of the commonly targeted coastal fishery resources: Prince (2013), Gleason et al. (2014) and Moore (2015).
- The last trochus harvest was in 2013, when 350 mt was harvested. (BBP 2014)

A household income and expenditure survey (HIES) was carried out in 2014. That survey was the new "fisheries-useful" type, promoted by SPC and described in the FSM section of this book. The results are still being finalised and are therefore unavailable for this study.

There are a number of anecdotes obtained by the present study during a short visit to Palau in September 2015 that are conceivably applicable to estimating coastal fisheries production in Palau:

- Staff of the Bureau of Marine Resources indicate that current prices paid to fishers range from US$1.50 to US$2 per pound, with the average being about US$1.70 per pound (US$3.75/kg).

- There appears to be a general feeling among fisheries specialists in Palau that 30% to 50% of Palau's commercial fish catch for consumption goes through the store known as Happy Fish Market. The remainder is sold by roadside vendors or directly to restaurants. Some of the fish sold at the market is for individuals for export purposes.
- The owner of the Happy Fish Market indicates that he has bought about US$500,000 worth of fish[1] from fishers annually in recent years, with about 20% of his fish purchased from locally based offshore longliners and 10% from trolling by small-scale vessels outside the lagoon. (S. Remoket, per. com. September 2015) There is no independent verification of this information.
- Although there monitoring of fish exports occurs at the airport (including coastal fish exports), the results of that monitoring are not readily available.

Some of the anecdotes in this section conflict with the observations of researchers. The events presented above that could impact on coastal fisheries production include some items that could increase fisheries production in Palau and others that could decrease production. It appears that the information available to the present study is inadequate for updating the historical estimates of coastal fisheries production in the country. In this situation it is considered most appropriate to maintain the coastal production volumes estimated in the Gillett (2009) study, and to increase the values given in that study to 2014 values.

Palau's coastal commercial fisheries production in 2014 is deemed to be 865 mt, worth US$3.2 million to fishers.

Coastal Subsistence Catches

Following the above approach, the coastal subsistence fish catch in Palau in 2014 is deemed to be 1,250 mt. Using the "farm gate" system of valuing subsistence production (discounting prices for commercial fish by 30%) this would be worth US$3.3 million to fishers.

Locally Based Offshore Catches

According to an official of Palau's Bureau of Oceanic Fishery Management, the locally based offshore fleet in 2014 consisted of 32 longliners operated by three companies, plus a single pole-and-line vessel operated by another company (K. Sisior, per. com. September 2015). Information in BOFM (2015)

1 US$500,000 value of fish at US$3.75/kg equates to 133 mt of fish.

and FFA (2015) can be used to estimate the volume and value of the locally based offshore fleet (Table 13-1).

Table 13-1: Recent Catches by Palau-Based Longliners

	2010	2011	2012	2013	2014
Tuna catch Chinese Taipei longliners (mt)	1,616	1,505	809	1,075	2,486
Tuna catch Belize longliners (mt)	0	0	5	237	504
Total catch longline adjusted for bycatch (mt)	2,101	1,957	1,058	1,706	3,887
Value adjusted for bycatch and transport (US$)	16,806,400	15,652,000	8,465,600	13,644,800	31,096,000

Source: BOFM (2015) and FFA (2015)

In addition to the above, the catches from the single Palau-based pole-and-line tuna vessel must be considered. A paper on global pole-and-line status (Gillett 2015) estimates that the Palau landings were about 100 mt in 2014. The value of that catch to fishers would be about US$375,000.

In 2014 the Palau-based offshore fishing vessels are estimated to have caught 3,987 mt, worth US$31,471,000 to fishers.

Foreign-Based Offshore Catches

BOFM (2015) gives the foreign-based longline catch in the Palau zone (all Japanese). The purse seine catch in the Palau zone (all foreign-based) is given in FFA (2015). These catches are summarised in Table 13-2.

Table 13-2: Foreign-Based Offshore Catches in the Palau Zone

	2010	2011	2012	2013	2014
Volume purse seine catch in the Palau zone (mt)	336	0	738	310	2,825
Volume longline catch in the Palau zone, adjusted for bycatch (mt)	745	945	1,032	1,021	1,192
Value purse seine catch, adjusted for transport (US$)	621,869	0	1,365,890	573,748	5,228,510
Value longline catch, adjusted for bycatch and transport (US$)	8,329,100	10,565,100	11,537,760	11,414,780	13,326,560

Source: BOFM (2015) and FFA (2015)

In 2014 foreign-based offshore fishing vessels are estimated to have caught 4,017 mt, worth US$18,555,070 to fishers.

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. Anon. (2005) states that 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. The longest river in Palau, the Ngerdorch River, drains from Lake Ngardok and flows 10 km to its mouth in Ngchesar State, on the east coast of Babeldaob.

Staff of the Bureau of Marine Resources 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 purpose of the present study, annual freshwater fisheries production in Palau in recent years is taken to be 1 mt, 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. Culture of a large number of organisms has been attempted in Palau over four decades, both at the centre and independently.

Aquaculture production in Palau is currently confined to milkfish, giant clams and, to a far lesser extent, coral, mangrove crab, groupers and rabbitfish. One of the giant clam producers in Palau stated: "Milkfish is now the only real commercial aquaculture commodity in the country; all others are cultured on a semi-hobby basis." (T. Watson, per. com. September 2015).

With regard to milkfish culture, Palau has three farms: the Ngatpang State Milkfish Farm, the Shallum Etpison Palau Aquaculture Project, and the Melwert Tmetuchel Airai Fish Farm. These farms import fry from hatcheries in Taiwan or the Philippines for grow-out to supply both fresh fish to the public and bait fish for the tuna longline fishery (Pickering et al. 2013).

According to staff of the Bureau of Marine Resources, two of those farms combined sell about 500 pounds of fish about every two weeks, at around US$2.75 per pound. The other milkfish farm is dedicated to producing bait. The latter sold 327,800 individual baitfish in 2014, at a price of US$.20 per piece (M. Tmetuchl, per. com. September 2015).

With regard to giant clam culture, there are five to ten small companies that produce four different species. According to staff of the Bureau of Marine Resources, 8 to 10 cm clams are worth US$5–6 apiece, and larger sizes are sold to local restaurants for US$6 to US$10 per clam. According to the CITES database, a total of 19,173 live giant clams were exported from Palau in 2013. In 2014 one of the producers experienced difficulties in obtaining small clams for growing out (T. Watson, per. com. September 2015).

The current aquaculture production of coral, mangrove crab, groupers and rabbitfish appears to be either very small or non-existent.

The above information is inadequate for making a good estimate of aquaculture production in Palau in 2014. For the purposes of the present study, 2014 production is deemed to be: (a) 22 mt of milkfish plus 327,800 pieces worth about US$200,000 at the farm gate, and (b) 16,000 pieces of giant clams (for both the aquarium and restaurant trade), worth US$85,000 at the farm gate – representing a total 2014 production of 22 mt and 343,800 pieces, worth US$285,000.

Summary of Harvests

A crude approximation of the annual volumes and values[2] of the fishery and aquaculture harvests in 2014 can be made from the above sections (Table 13-3).

Table 13-3: Annual Fisheries and Aquaculture Harvest in Palau, 2014

Harvest Sector	Volume (mt, and pcs where indicated)	Value (US$)
Coastal Commercial	865	3,200,000
Coastal Subsistence	1,250	3,300,000
Offshore Locally based	3,987	31,471,000
Offshore Foreign-based	4,017	18,555,070
Freshwater	1	10,000
Aquaculture (pcs and mt)	22 mt and 343,800 pcs	285,000
Total	**10,142 mt and 343,800 pcs**	**56,821,070**

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.

Palau's coastal commercial fisheries production in 2014 is deemed to be 865 mt, worth US$3.2 million. The methodology used to estimate coastal fisheries production (both commercial and subsistence) is quite weak.

Figures 13-1 and 13-2 show the volumes and values of the 2014 Palau fisheries production. Aquaculture is not shown on the volumes figure due to the use of mixed units (pieces and mt).

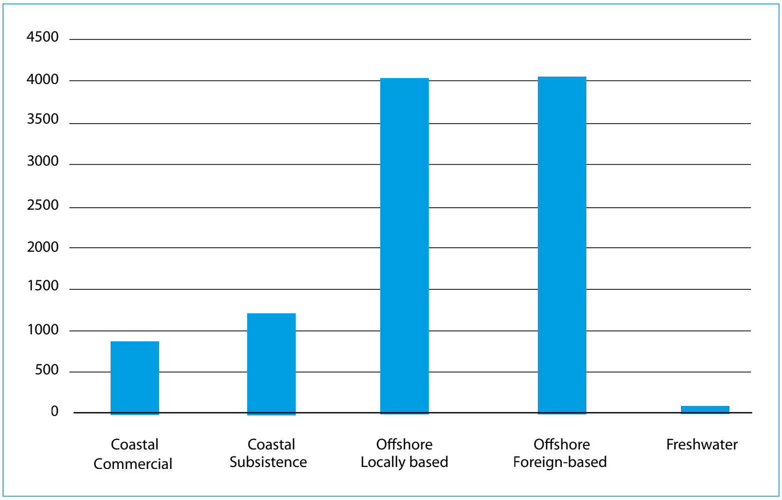


Figure 13-1: Palau Fisheries Production by Volume (mt), 2014

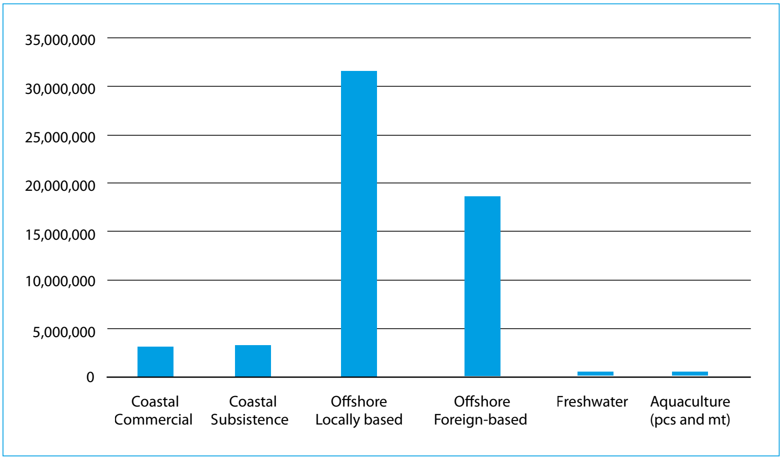


Figure 13-2: Palau Fisheries Production by Value (US$), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for Palau from those three studies are provided in Table 13-4.[3]

Table 13-4: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, and pcs where indicated)	Nominal Value (US$)
Coastal Commercial	1999	865	2,595,000
	2007	865	2,843,000
	2014	865	3,200,000
Coastal Subsistence	1999	1,250	2,500,000
	2007	1,250	2,511,000
	2014	1,250	3,300,000
Offshore Locally based	1999	2,500	12,500,000
	2007	3,030	13,779,656
	2014	3,987	31,471,000
Offshore Foreign-based	1999	124	270,000
	2007	1,464	4,947,496
	2014	4,017	18,555,070
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 mt	50,000
	2014	343,800 pcs and 22 mt	285,000

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

The apparent changes in production for the three-year period represents a real change in production in some cases, but this can also represent a change in the methodology for measuring the production (hopefully an improvement). In the table above, the volume of production for coastal commercial, coastal subsistence and freshwater did not change between the years. This is

3 The earliest Benefish Study, Gillett and Lightfoot (2001), did not include aquaculture, freshwater fisheries or the non-independent territories.

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 and aquaculture (based on the availability of better quality data) are likely to 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 Graduate School (2015). A more detailed disaggregation of the contribution is provided in Table 13-5 below.

Table 13-5: Fisheries Contribution to the Palau GDP (US$ thousands)

	FY2010	FY2011	FY2012	FY2013	FY2014
Aquaculture	84	912	807	454	337
Fishing support services	568	519	705	703	589
Fishing coastal fish	1,721	1,808	1,912	1,977	2,008
Fishing coastal non-fish	88	168	371	77	205
Subsistence	1,989	2,090	2,210	2,286	2,321
Total fisheries	4,450	5,497	6,005	5,497	5,460
Palau GDP	183,642	200,774	215,539	228,310	249,082
Fisheries as a % of GDP	2.4%	2.7%	2.8%	2.4%	2.2%

Source: Bureau of Budget and Planning (unpublished data)

Method Used to Calculate the Official Fishing Contribution to GDP

The documentation that accompanies the unpublished data from which the table above is constructed includes an explanation of the sources of the data:

- Aquaculture: social security and taxation databases
- Fishing support services: trade database
- Fishing coastal fish: Gillett (2009)
- Fishing coastal non-fish: trade database
- Subsistence: Gillett (2009)

The individuals in the Graduate School responsible for the national accounts have a considerable amount of national accounts expertise and years of experience in Micronesia. For various reasons, described in Section 31-4 of this book, those individuals have decided to treat the fishing sector in Palau somewhat differently than, for example, the International Monetary Fund and what is described in Appendices 2 and 3 of this book (hence "fisheries" instead of "fishing" in Table 13-5 above). The major changes the Graduate School has made are excluding the value added from foreign-owned locally based fishing vessels, but including the shore-based services of the companies operating those vessels. (G. McKinlay, per. com. September 2015).

Alternative Estimate of Fishing Contribution to GDP

Table 13-6, 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 13-3), 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 13-6 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 13-6: Fishing Contribution to GDP in 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production (US$, from Table 13-4)	VAR	Value Added (US$)
Coastal Commercial	3,200,000	0.70	2,240,000
Coastal Subsistence	3,300,000	0.80	2,640,000
Offshore Locally based			
Longlining	31,096,000	0.20	6,219,200
Pole-and-line	375,000	0.60	225,000
Freshwater	10,000	0.95	9,500
Aquaculture	285,000	0.60	171,000
Total	**38,266,000**	--	**11,504,700**

Source: This chapter, and VARs from Appendix 3

In 2014 the fishing contribution of US$11,504,700 represents about 4.6% of the US$249 million GDP of Palau.

The major difference between the above estimate and the official estimate of the fisheries contribution given in the section above is obviously that the official estimate includes shore-based services and excludes the operations of some locally based industrial fishing vessels. Both the methodology of the official estimate and that of the present study have their respective advantages. The former is oriented towards obtaining a picture of the entire national economy – and the ups/downs of industrial tuna fishing may distort other important changes in the economy. The present study is fisheries-oriented and, as such, it is important for tracking the economic contribution of locally based fleets – something that most countries of the region (including FSM) have been promoting for many years. Also, it is important for comparison purposes that the present study uses a methodology consistent with Gillett (2009).

13.3 Exports of Fishery Production

The official statistics on exports from Palau are given in Graduate School (2015). A summary of the export items of relevance to fisheries is provided in Table 13-7.

Table 13-7: Value of Fishery Product Exports (US$ millions)

	FY2011	FY2012	FY2013	FY2014
Exports of goods	12.8	15.0	14.4	19.1
Re-exports	11.2	12.8	13.1	17.8
Fuel	10.2	11.7	10.2	11.5
Other, mostly capital goods	1.0	1.1	3.0	6.3
Other exports	1.6	2.3	1.3	1.3
Exports of services	102.8	104.0	125.7	142.4
Fish processing	1.1	1.5	1.5	1.2

Source: Graduate School (2015)

From the information in the above table it appears that the overseas shipment of the catch of locally based offshore vessels is not considered an export of the country in the official statistics, but rather the fish processing that occurs on that fish is considered an export of a service. The value of the service in the table (US$1.2 million) appears to be about 11% of the free-on-board (FOB) value of the fish exported (as estimated below). The exports of "other goods" in the table is not disaggregated to the point of being able to determine reef fish exports, and it is unclear whether fish exports as passenger baggage are part of the official exports.

The World Bank categorises Palau exports in a different manner from is the above descriptions (the bank includes the exported catch of locally based offshore vessels). In 2014 Palau's fish exports are given as US$11.4 million.[4]

The Bureau of Oceanic Fisheries Management tracks what they consider as exports from the locally based offshore vessels. The figures for 2012–2014 are given in Table 13-8. Using the weight of exports in the table, in conjunction with tuna price information in FFA (2015), the FOB value can be estimated as approximately US$12.7 million in 2013 and US$10.5 million in 2014.

Table 13-8: Exports of Tuna, Billfish, and Loins

Year	Pieces	Weight (kg)
2012	53,155	1,998,356
2013	44,079	1,713,437
2014	37,151	1,425,610

Source: Bureau of Oceanic Fisheries Management (unpublished data)

Data from Palau's Customs Department, kindly provided by SPC's Statistics for Development Division, gives information on exports of all types of fishery products. In 2013 there were 1,797,135 kg of such exports, with a declared FOB value of US$6,612,902. This is an average value of US$3.68 per kg, which seems low, especially as sashimi-quality tuna (FOB value was about US$7.39/kg in 2014) make up most of the exports. This US$6.6 million FOB value (which includes the exports of the locally based offshore vessels) is half of the value estimated above for just the exports from the locally based offshore vessels.

The following is a summary of further relevant information on fishery exports from Palau:

- Rhodes et al. (2011) indicate that the export of reef fish is 213 mt, plus/minus 60 mt. The FOB value of 213 mt of reef fish is about US$877,000.
- According to the CITES database, a total of 19,173 live giant clams were exported from Palau in 2013. At US$5.50 per clam, that represents an FOB value of about US$105,451.

4 its.worldbank.org/CountryProfile/en/Country/PLW/Year/2014

- Apparently, the last trochus harvest was in 2013, when an FOB value of US$350,000 was exported (BBP 2014).
- Although monitoring of fish exports occurs at the airport, the results of that monitoring are not readily available.

The recent FOB value of exported reef fish and giant clams estimated above is close to US$1 million – which is almost as large as all of the bona fide exports of the county, as given in the table at the beginning of this section (i.e. "other exports"). The FOB value of the exports from locally based offshore vessels has been about US$11 million annually in recent years. If both (a) reef fish and giant clams, and (b) exports from locally based offshore vessels are considered "exports" then virtually all of the exports of the country (given above by the World Bank to be US$11.4 million in 2014) are fishery products.

13.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

There are five arrangements by which Palau receives payment for foreign fishing in its waters:

- The locally based foreign fleet: there are three locally based fishing companies that have been operating for some years.
- The Japanese agreement: this covers three types of tuna fishing by vessels based in Japan: longline, pole-and-line and purse seine. In its present form, the agreement has been in effect since 1992, with minor changes. Although the agreement covers fishing by all three methods, there has been no Japanese pole-and-line fishing in Palau waters since 1994. (M. McCoy, per. com. November 2008).
- US treaty: under the terms of the US multilateral tuna treaty, Palau and other Pacific Island countries receive payments from the US government and the US tuna industry, which are associated with fishing access by US purse seine vessels. Some Pacific Island countries consider that all payments under the US treaty are for fishing access, while others treat some components as aid.[5]
- The FSM Arrangement: this is a treaty between participating Pacific Island countries that allows access on favourable conditions to fishing zones by purse seine vessels registered in those participating countries.

5 In the table 13-9, the amounts listed are taken as though all fees are for access.

- The Parties to the Nauru Agreement Vessel Day Scheme (PNA VDS): the Parties to the Nauru Agreement have the Vessel Day Scheme, in which foreign purse seine vessels purchase fishing days from PNA countries.

Unpublished data kindly provided by Palau's Bureau of Oceanic Fisheries Management was used to construct Table 13-9. It shows the payments received by Palau under these five arrangements.

Table 13-9: Access Fees for Foreign Fishing in the Palau Zone (US$)

	Locally based foreign fleet	Japan-based (longline and purse seine)	Other purse seine (US treaty, FSM Arrangement,PNA/VDS)	Total
2010	219,000	373,362	353,786	946,147
2011	283,502	448,577	1,060,773	1,792,852
2012	284,600	867,120	1,541,914	2,693,634
2013	265,488	196,100	3,242,037	3,703,625
2014	262,079	433,998	2,924,510	3,620,586
Total 2010–2014				12,756,844

Source: Bureau of Oceanic Fisheries Management (unpublished data)

The total revenue of the Palau government (including tax revenue, grants and other revenue) is US$108.6 million (Graduate School 2015). The US$3.6 million in access fees in the above table therefore represents about 3.3% of the government's revenue.

Graduate School (2015) contains a section on balance of payments, which has some data on "fishing license fees" by fiscal year (in US$ millions), as follows:

- FY2010: US$1.1 million
- FY2011: US$1.7 million
- FY2012: US$1.5 million
- FY2013: US$3.4 million
- FY2014: US$4.6 million[6]
- Total FY2010 to FY2014: US$12.3 million

At least some of the difference between the two sets of access fees, above, can be explained by the use of calendar years (BOFM data) and fiscal years (Graduate School). Also, different methods used to account for government revenue (i.e. cash method vs the accrual method) could cause a difference for some years.

6 In the government revenue section of Graduate School (2015), "Royalties (fishing fees)" are given as US$3.151 million in FY 2014

Other Government Revenue from Fisheries

The other significant source of direct government revenue from fisheries activities is the fish export tax. During the period 1999 to 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. Unpublished data from the Bureau of Oceanic Fisheries Management shows the tax collected in recent years, as follows: 2012: US$699,425; 2013: US$248,319; 2014: US$498,963.

In addition to the export tax, the government also charges fees for several activities related to fisheries, including the following:

- Marine Export Declaration Fee: citizen (US$5), non-citizen (US$10),commercial (US$25), scientific research (US$25)
- CITES permit: non-commercial (US$5), commercial (US$25), scientific research (US$25)

13.5 Fisheries-Related Employment

The Fiscal Year 2014 Statistical Appendices (Graduate School 2015) has information on employment in Palau, obtained through the Social Security and tax records, and therefore relates to formal wage-paying jobs. Table 13-10 summarises the fisheries-relevant information contained in the Statistical Appendices.

Table 13-10: Information about Formal Jobs in the Fishing Sector

	FY2010	FY2011	FY2012	FY2013	FY2014
Number of fishing workers	92	87	85	81	83
Total number of workers in Palau	10,044	9,931	9,973	10,108	10,386
Fishing workers as a % of all workers	0.9%	0.9%	0.9%	0.8%	0.8%
Fishing workers that are Palau citizens	22	19	19	15	17
Palau citizen fishing workers as a % of all fishing workers	23.9%	21.8%	22.4%	18.5%	20.5%
Fishing average wages (US$)	4,434	4,589	4,856	4,983	5,459
All workers average wages (US$)	8,541	8,898	9,188	9,265	9,950
Fishing wages as a % of average wages	51.9%	51.6%	52.9%	53.8%	54.9%

Note: The number of workers includes both full-time and part-time workers
Source: Graduate School (2015)

From the table it can be seen that, in Palau, formal employment in the fishing sector is characterised by a small portion of people formally employed, most not being Palau citizens, and with relatively low wages – about half of the average wage in the country.

FFA (2015) has information on the employment of Palauans in the tuna industry (Table 13-11). Thirty-six Palauans were employed in the tuna industry in 2014. Across the Pacific 17,663 people were employed as crew on tuna vessels or in tuna processing. Tuna-related employment in Palau therefore represents 0.2% of the regional tuna-related employment.

Table 13-11: Employment of Palauans in the Tuna Industry

	2009	2010	2011	2012	2013	2014
Local crew on vessels	3	0	0	0	0	0
Processing and ancillary	8	7	84	70	36	36
Total	**11**	**7**	**84**	**70**	**36**	**36**

Source: FFA (2015)

Although formal employment in the fishing sector is small in Palau, many people have non-formal fishing jobs, and there is a high level of involvement in subsistence fishing. SPC's ProcFish programme surveyed four locations in Palau that were representative of the country in terms of fisheries conditions (Friedman et al. 2009). In terms of participation in fisheries, the survey showed that 62.7% of households were involved with reef fisheries in Koror, 62.7% in Ngarchelong, 88% in Ngatpang, and 77.8% in Airai. The ProcFish work in Palau also showed that 68% of fishers were men and 32% were women.

The 2005 census contains some information on employment in fisheries (Office of Planning and Statistics, 2005). Unfortunately, much of the employment-relevant data is aggregated with jobs from other sectors. For example, in 2005 there were 559 people with the occupation of "farming, forestry, and fishing". Information that is specific to fisheries-related employment includes the following:

- Of the 13,800 people reporting income in 2004, 305 people (2.2%) reported income from selling fish.
- Of 14,154 people over 18 years old in 2004, 933 people (6.6%) reported some subsistence fishing activity.
- Of the 933 subsistence fishers, 186 (19.9%) were female.

- The census defined participation in subsistence activities if he/she mainly produced goods for his/her own or family's use and needs, and this is therefore only a small subset of all people involved in subsistence fishing.

13.6 Levels of Fishery Resource Consumption

Preston (2000), using 1995 FAO production, import, and export data, indicated annual per capita fish consumption in Palau of 85 kg.

Fifteen years ago the Palau Conservation Society estimated: (i) local coastal production of 2,115 mt; (ii) fishery product imports of 610 mt; (iii) fishery product exports of 400 mt; (iv) a mean resident population in Palau in the 1990s of 16,600; and (e) visitors to Palau (full-time resident equivalents) of 500. This equates to annual per capita fishery product consumption of 135 kg (PCS 2000).

Gillett (2009) updated the above PCS estimate with new estimates of population and local consumption of the production from offshore fisheries:

- SPC (2008) indicated that the mid-2007 population of Palau was 20,162.
- 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.
- 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 ProcFish programme surveyed four locations in Palau that were representative of the country in terms of fisheries conditions (Friedman et al. 2009). 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. (2009) uses information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES 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:

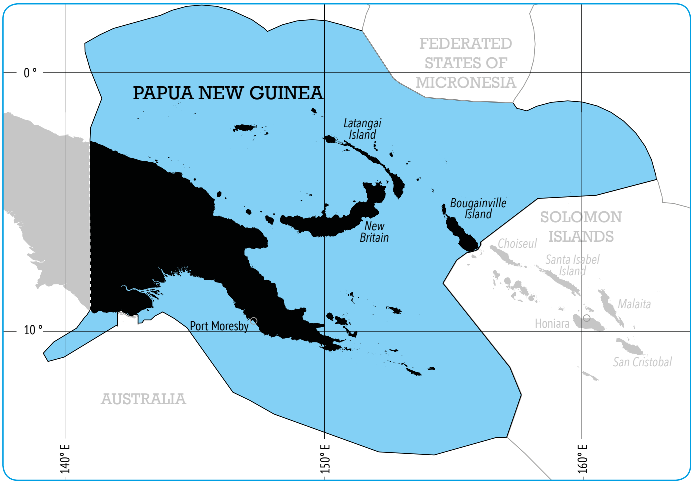
- Gillett (2009) expressed some reservations about the fish production amounts from the 2006 Palau HIES, on which this estimate was based.
- The ProcFish results, above, indicate a Palau consumption rate about twice as high as the Bell et al. (2009) estimated rate.

The locally based offshore fishing operations sell fish locally and donate some fish for various activities in Palau. During the most recent five-year period a total of 68.3 mt of fish was donated, and 349.6 mt was sold from the longline companies (Bureau of Oceanic Fishery Management, unpublished data). The sole pole-and-line vessel had recent average annual catches of about 100 mt (Gillett 2015). This equates to 183.6 mt of fish entering the Palau food supply each year from locally based offshore fishing. It is unclear whether the previous estimates of Palau fish consumption cited above have adequately considered this fish source.

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 following describe some of the main historical attempts to estimate production from coastal commercial fisheries in Papua New Guinea (PNG):

- Dalzell et al. (1996), using information from the late 1980s and early 1990s, estimated that PNG's coastal commercial fisheries annually take 4,966 mt, worth US$22.1 million.
- Preston (1996) states that the annual commercial fisheries production in the mid-1990s was about 4,800 mt, worth K16.4 million (PNG Kina (K)).

- Gillett and Lightfoot (2001) considered several sources of information for coastal commercial production for the years 1989 to 1991, and ventured an estimate of 5,500 mt, worth K55 million.
- Gillett (2009) 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 mt, worth K80 million to the producer.

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 previous estimates, based on known changes that may affect fisheries production and various sources of recent information on the economically important coastal commercial fisheries.

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 many Pacific Island countries, the PNG case is perhaps the most difficult to improve, due to the size of the country, the number of coastal villages and the isolation of many production sites. Another factor is the reduction in the amount of information that is readily available from the National Fisheries Authority (NFA). In the past a substantial amount of information on the production from various coastal commercial fisheries was contained in NFA annual reports and newsletters. The last NFA annual report was for 2012 (L. Gisawa, per. com. August 2015), but even that issue is currently not readily available. The NFA newsletters ceased in 2013 (G. Puri, per. com. August 2015).

Some specific features and recent changes that should be taken into consideration in estimating production from PNG's coastal fisheries are described below:

- The population of PNG has increased from 6,324,106 in 2007 to 7,570,686 in 2014 (a 16.5% increase).
- The situation is fairly good with respect to the sustainability of the exploitation of the fisheries. Overall, exploitation of coastal fisheries in PNG is thought to occur below localised maximum sustainable yields, although fishing pressure has seen the collapse of some fisheries in some localities, especially in areas close to urban centres, and has resulted in a nation-wide moratorium on beche de mer trade. (NFA 2015)
- The rehabilitation of several ice-producing plants and coastal fisheries centres has facilitated a moderate increase in coastal fisheries production. (A. Taunega, per. com. August 2015)
- The beche de mer trade was closed in 2009 for an initial three-year period, and this closure was then extended for another three-year period. (J. Kinch, per. com January 2016)
- There was a moderate spike in the cost of fuel in 2008.
- Other than the beche de mer ban and the fuel spike, NFA staff could not identify other major disruptions or shocks to coastal fisheries production.

Information obtained from discussions with NFA staff and other fishery stakeholders, and from the limited amount of documentation, is used to describe some recent features and changes in the major coastal commercial fisheries in the country. The sources are personal communications (L. Gisawa, J. Kinch and M. Brownjohn), Carleton (2013), SPC (2012), NFA (2008), NFA (2015), Barclay and Kinch (2013), and Sullivan and Ram-Bidesi. (2008):

- **Beche de mer:** The 15-year (1998–2012) average production was 467 mt (dry weight), at US$23/kg (2012 prices). The historical high was in 2006, when 679 mt (worth K37 million) was produced. The fishery was closed in 2009.

- **Lobster:** The fishery has experienced little net change in volume, but there had been a gradual increase in price, which has stalled recently. The new live trade into Australia (only one PNG operator) has changed the fishery in accommodating live supply, and increased lobster prices.
- **Prawn:** Annual production has historically typically varied between 400 mt and 1,300 mt, but both the number of active boats and production have declined in recent years. The current management plan allows only 14 boats to participate in the fishery.
- **Trochus:** From a maximum-recorded harvest in 1989 of 568 tonnes, the production declined to about 345 mt in the mid-2000s. When the beche de mer fishery closed in 2006 trochus production increased.
- **Artisanal shark fishing:** This activity increased considerably with the ban on pelagic shark fishing in mid-2014, and then again with the closure of the beche de mer fishery. The pelagic shark fishery was closed in response to a Western and Central Pacific Fisheries Commission (WCPFC) management measure prohibiting the taking of silky sharks, which made up about 83% of the commercial catch. (M. Brownjohn, per. com. January 2016)
- **Barramundi:** This fishery now produces about 80–100 mt per year, which is still well below the more than 300 mt of past years.
- **Gamefishing:** This fishery has gradually increased in the last two decades, in both marine and freshwater.
- **Artisanal deep water snapper:** This fishery has declined, which is at least partially due to the inefficient, petrol-driven boats used in the fishery, fuel cost increases, and markets.
- **Various coastal fishery development schemes:** The initiatives of various agencies (e.g. IFAD, EU, GTZ) and of the PNG government to increase production from under-exploited fishery resources have usually collapsed when subsidies have stopped.

Further to the final point, above, 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. Two decades ago Preston (1996) 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 information presented in this section is entirely inadequate for estimating coastal commercial fisheries production in PNG. The amount and quality of information to enable reasonably-well-informed "guesswork" appear to have deteriorated in the last two decades.[1] The approach taken in the present study is to take the Gillett (2009) estimates, and adjust them for the relevant information in this section. Overall, this appears to result in a moderate increase in the volume and value of coastal commercial fisheries production between 2007 (the focal year for the 2009 study) and 2014 (the focal year for the present study).

The production from PNG coastal fisheries is deemed to be 6,500 mt, with a value to the producer of K130 million.

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 mt, worth US$41,176,000.

1 Staff of the National Statistics Office (NSO) indicated that, with a modest amount of funding, the latest household income and expenditure survey (HIES) could be re-analysed for fishery production information. (H. Kari and D. Skutenko, per. com. August 2015). This could lead to a remarkable improvement in the estimates of coastal commercial fisheries production (both commercial and subsistence). Alternatively, with some fisheries input, the NSO could design the next HIES (likely to be in 2018) to be more "fisheries friendly".

- Preston (1996), using several sources, concluded that PNG's subsistence fisheries annually take 26,000 mt.
- Gillett and Lightfoot (2001) considered the above two estimates, and other information. to venture annual estimates of 26,000 mt in catch, worth K52 million.
- Gillett (2009) considered the 2001 study, above, and the results of a 1996 household income and expenditure survey. He estimated the coastal subsistence production of PNG in the mid-2000s to be 30,000 mt, worth K105 million.

To some degree, the above estimates have been institutionalised. For example, NFA (2015) states: "annual coastal subsistence fisheries catches in PNG range from 20,600 to 30,000 tons."

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. Accordingly:

- the volume of the 2014 subsistence production is estimated to be 30,000 mt, plus an adjustment for the change in population in the 2007–2014 period (a 16.5% expansion), or about 35,000 mt; and
- assuming that the average fish price in non-urban markets was K7 per kg in 2014 (L. Gisawa, G. Puri, per. com. August 2015), and using the farm gate system of valuing subsistence production in the Pacific Islands (Bain 1996)[2], this coastal subsistence production of 35,000 mt can be valued at K171.5 million to producers.

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 (Usu et al. 2015) gives information on the PNG-based offshore fishery:

> The Papua New Guinea (PNG) tuna fishery is made up of both the purse-seine and longline sectors with a small handline sector. The longline and handline sector is a citizen - only activity and all vessels fish exclusively in the waters under PNG national

2 Discounting the average fish price in the market by 30 percent as allowance for getting the product to market.

> jurisdiction[3]. The purse-seine sector is a mix of both domestic and foreign access vessels. The domestic sector comprises the PNG flag vessels and PNG chartered vessels (locally based foreign) which support processing facilities onshore in PNG. While the PNG flagged vessels fish primarily in PNG waters, the chartered vessels fish both in PNG waters and waters outside of PNG.

For the purposes of the present study, the PNG-based purse seine vessels are taken to be PNG-flagged vessels and locally based foreign vessels. The affiliations of these vessels are complex. A study carried out in early 2015 (McCoy et al. 2015) gives information on this fleet (Table 14-1). The number increased further in late 2015 due to access policy changes.

Table 14-1: Summary of Number of Vessels Associated with PNG-Registered Companies and Locally Based Foreign Companies

Company Granted Licenses	Parent Company and Nationality Linkage	Parent Company Relationship to Vessels	Number of Purse Seiners
Frabelle (PNG) Ltd	Frabelle, Philippines	owner	11
Frabelle Fishing Corporation	Frabelle, Philippines	owner	4
Pacific Blue Sea Fishing	Philippines	owner	1
Dologen Ltd.	PNG	(operates in conjunction with Frabelle)	1
Rell & Renn Fishing (PNG) Ltd	Philippines	owner	1
RD Fishing PNG Ltd	RD, Philippines	owner	17
South Seas Tuna Corporation Ltd (SSTC)	FCF, Taiwan	Agent for Taiwanese and other owners	14
Fair Well Fishery (PNG) Ltd	Fair Well Fishery Co. Ltd, Taiwan	owner	5
Majestic Seafoods Corporation	Thai Union, Thailand; Century Canning Corp., and Frabelle, Philippines	Believed to be Frabelle	8

Source: McCoy et al. (2015)

The production of the PNG-based seiners is given in Usu et al. (2015). The value of this catch is determined by information in FFA (2015). The values (at overseas destinations) are adjusted to equate to PNG in-zone prices. This volume and value information is given in Table 14-2.

3 It is reported that there are six Taiwanese longline vessels with Taiwanese crew fishing out of Kavieng, under a local licence held by Nuigini Island Seafood Products. (J. Kinch, per. com. January 2016)

Table 14-2: Catches of the PNG-Based Purse Seiners (catches include non-tuna species)

	2010	2011	2012	2013	2014
Volume: PNG-flagged purse seiners (mt)	27,972.30	26,869.82	46,085.78	38,419.44	54,770.86
Volume: PNG-based foreign purse seiners (mt)	177,865.17	171,888.86	193,124.12	188,642.09	160,433.05
Volume: total catch by PNG-based purse seiners (mt)	205,837.47	198,758.68	239,209.9	227,061.53	215,203.91
Value: total catch by PNG-based purse seiners (US$)	247,653,694	331,005,644	479,160,215	429,208,292	307,240,640

Source: Usu et al. (2015)

Usu et al. (2015) give information on PNG-based longliners:

> The low catch and effort is due to a reduced number of tuna longline vessels from 27 active vessels in 2012 to 10 active vessels in 2014. The high cost of goods and services such as fuel and shipping still proves to be a challenge in longline operations. Moreover, 7 vessels lost their license to fish in PNG waters after the first quarter of 2013 as a result of their company's failure to meet licensing conditions and more vessels have gone for repairs in the 2014 fishing period.

The catches for the PNG-based longliners are provided in Table 14-3. The volumes are based on Usu at al. (2015), and the values are based on FFA (2015), adjusted by the lower value of the bycatch and by transport costs to overseas markets (i.e. to equate to PNG in-zone prices).

Table 14-3: Catches of the PNG-Based Longliners (catches include non-tuna species)

	2010	2011	2012	2013	2014
Volume: PNG-flagged longliners (mt)	3,501.95	2,655.83	3,103.66	1,430.45	1,106.12
Value: catch by PNG-based long-liners (US$)	12,130,283	11,133,254	12,213,381	5,065,786	3,980,384

Source: Usu et al. (2015)

The following summarises some relevant production information on other types of locally based offshore fishing:

- A small handline fleet of about five vessels is operating in waters around Madang and Morobe provinces. Catch by these vessels, which do not normally exceed 10 mt (estimate) per year, is sold to processing companies and local supermarkets (Usu et al. 2015). The value of this catch to fishers in 2014 is assumed to be K150,000 (based on an informed estimate).
- A shark longline fishery operated for several years. The fishery was limited to 9 vessels, setting 1,200 hooks per day, with a total allowable catch of 2,000 mt dressed weight per year. All vessels in this fishery fished only in PNG waters. The shark fishery was closed in mid-2014 due to high catches of silky sharks, which is regulated by a WCPFC measure. The total 2014 catches of the shark fleet are estimated to be 576.57 mt. (Usu et al. 2015) The value of this catch to fishers in 2014 is estimated to be K3.7 million.

The following summarises the 2014 PNG-based offshore catches:

- Purse seine: 215,204 mt, with an in-zone value of US$307,240,640 (K789,608,445)
- Longline: 1,106 mt, with an in-zone value of US$3,980,384 (K10,229,587)
- Handline and shark fishing: 586 mt, worth to fishers K3,850,000
- Total: 216,896 mt, worth K803,688,032

Foreign-Based Offshore Catches

According to the paper presented by the PNG delegation to the 2015 meeting of the Scientific Committee of the WCPFC (Usu et al. 2015), the tuna catch in PNG waters by foreign-based offshore fishing vessels consisted entirely of fish caught by purse seine fishing gear. The report states: "The vessels are licensed under the conditions of access agreements between PNG and their company, fishing association or home party state and also include foreign vessels fishing under the terms of the US Treaty and FSM Arrangement. In the last five years, annual catches by foreign vessels fishing in PNG waters have averaged around 365,270.13 mt."

It is not possible to calculate the catches of foreign-based purse seiners in the PNG zone using only information contained in Usu et al. (2015). Although that publication gives the foreign purse seine catch in the PNG zone, it does not partition that catch into foreign locally based and foreign overseas based. FFA (2015) gives the total purse seine catches in the PNG zone, and by subtracting the locally based purse seine catches in the PNG zone (from the section above) from the total purse seine catch (from FFA 2015), the foreign-based purse seine catch in PNG can be determined (Table 14-4). The values given are derived from prices in FFA (2015), adjusted for bycatch and transport, with the latter to compensate for the fact that FFA prices are at destination markets overseas, while the offshore catch values of the present study are in-zone values.

Table 14-4: Calculating the Catches of the Foreign-Based Purse Seiners

		2010	2011	2012	2013	2014
1	Volume: total purse seine catch in PNG zone (FFA 2015,with addition or bycatch), mt	675,535	587,061	540,051	561,689	325,832
2	Volume of catch of PNG-flagged purse seiners in PNG zone (Usu et al. 2015), mt	27,971.46	26,869.82	45,973.14	36,960.09	44,171.85
3	Volume of catch of PNG-based foreign purse seiners in PNG zone (Usu et al. 2015), mt	114,468.14	122,315.58	114,533.01	114,520.10	63,789.32
4	Volume of catch of all PNG-based purse seiners in PNG zone (row #2 above plus row #3), mt	142,439.6	149,185.40	160,506.15	151,480.19	107,961.17
5	Volume of catch by foreign-based purse seiners in the PNG zone (row #1, above, minus row #4), mt	533,095	437,876	379,545	410,209	217,871
6	Value of catch by foreign-based purse seiners in the PNG zone, US$	641,394,617	729,222,467	760,264,488	775,406,661	311,048,127

Notes: The purse seine catches in Usu et al. (2015) include non-tuna species; the purse seine catches in FFA (2015) are only tuna (hence the adjustment in row #1)

In summary, the 2014 catches by foreign-based offshore vessels were 217,871 mt, with an in-zone value of US$311,048,127 (K799,393,686).

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 freshwaters 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 mt per year.

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 14-2 describes the river and its fisheries.

Box 14-2: The Fly River and its Fisheries

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 characterized 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 new 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 recent 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 FAO project to introduce new freshwater fish to the Sepik-Ramu river system in the early 2000s. (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 in inland fish markets is variable, but K7 per kg could be considered an average price. (G .Puri, per. com. August 2015)

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 (1966) made an educated guess of 13,500 mt annually, and this amount is often cited. Gillett (2009) took the Preston amount and increased it to account for population growth. With little alternative, the present study assumes that the 2014 PNG freshwater fishery production is that of the Gillett (2009) study, increased by the amount that the country's population has grown in the period 2007–2014. That equates to about 20,000 mt of freshwater fish per year. Assuming that the average fish price in inland markets was K7 per kg in 2014, using the farm gate system of valuation, a price of K4.90 per kg can be assigned to subsistence freshwater catches.

For the purpose of this study, the freshwater production of PNG in 2014 is taken to be 20,000 mt, worth K98 million. The very poor factual basis for this estimate is recognised.

Aquaculture Harvests

Discussion with staff of the Aquaculture and Inland Fisheries Section of the National Fisheries Authority, and with other knowledgeable individuals, enabled the compilation of information on recent aquaculture production in PNG. The results are presented in Table 14-5.

Table 14-5: Recent Annual Aquaculture Production in PNG

Commodity	Type of production	Current estimated annual production	Farm gate price	Annual production value (K)	Comment
Tilapia	Subsistence and small-scale commercial	100 mt	K9–11 per kg	K1,000,000	Estimates of up to 50,000 farms have been made, which, combined with a total PNG production of 100 mt, equates to an average of 2 kg per farm per year
Carp	Subsistence	20 to 30 mt	K7–10 per kg	K212,500	Many farmers have switched to tilapia recently
Seaweed	Small-scale commercial	300 mt	K1 per kg	K300,000	
Trout	Production for restaurants & supermarkets	5 to 10 mt	K30-35 per kg	K243,750	Started production in late 2007; currently only one farm due to feed issues
Prawn	Production for restaurants & supermarkets	10 mt	K45 per kg	K450	Recent ownership change
Pearl	Export	Not known	Not known	Not known	Farm which started production in 2007 is currently for sale.
Barramundi	Most production is currently oriented to re-stocking	100,000 to 200,000 fingerlings	K1 per fingerling	K150,000	Farm is partly owned by mining company that is accused of polluting the Fly River so production is related to the corporate social responsibilities of that company
Crocodile	Large and small operations for export	10,000 skins	K125 per skin	K1,250,000	A few large and many small farms.

Source: J. Wani, M. Brownjohn; Alitana Trout Farm staff; Mainland Holdings staff; Gillett (2009)

The above production equates to 145 mt, plus 160,000 pieces, with a farm gate value of K3,156,700.

For many years there has been a debate on the quantity of tilapia farmed in the highlands. A 2001 survey (Smith et al. 2007) alluded to a very large number of farms in that area. A student studying tilapia in PNG stated there are between 40,000 and 50,000 small-scale tilapia operations, which, based on the average number of ponds, stocking rates, mortality and expected output, would give an annual production of 924 mt (H. Vira, per. com. September 2015). However, the Executive Manager of NFA's Aquaculture and Inland Fisheries Section considered that the student's estimate of the number of ponds and the productivity of the ponds is too high, and he confirmed his estimate of annual tilapia production in PNG of 100 mt (J. Wani, per. com. August and October 2015).

Summary of Harvests

A crude approximation of the annual volumes and values[4] of the fishery and aquaculture harvest in 2014 can be made from the above sections (Table 14-6).

Table 14-6: Annual Fisheries and Aquaculture Harvest in PNG, 2014

Harvest Sector	Volume (mt, and pcs where indicated)	Value (K)
Coastal Commercial	6,500	130,000,000
Coastal Subsistence	35,000	171,500,000
Offshore Locally based	216,896	803,688,032
Offshore Foreign-based	217,871	799,393,686
Freshwater	20,000	98,000,000
Aquaculture	145 mt and 160,000 pcs	3,156,700
Total	**496,412 mt and 160,000 pcs**	**2,005,738,418**

The extremely weak factual basis for the estimates of coastal commercial, coastal subsistence and freshwater catches is acknowledged.

Offshore fishing in PNG in 2014 was somewhat atypical. This was a strong El Niño year, and purse seine catches characteristically move eastwards during El Niño periods (i.e. towards the Kiribati zone). This would explain why the total offshore catches (locally and foreign based) in the PNG zone in 2013 were 47% greater than those in 2014 (639,826 mt, compared with 434,767 mt).

4 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.

The following statement on the NFA website appears at odds with the K2 billion total fisheries production value for 2014 given in the table above: "The total market value of PNG catch is estimated at K350 to K400 million on average although information on the true value of artisanal fisheries is difficult to obtain and cyclical factors and commodity price movements, especially tuna, cause huge value swings from year to year."

Figures 14-1 and 14-2 show the volumes and values of the 2014 PNG fisheries production. Aquaculture is not shown on the volumes figure due to the use of mixed units (pieces and mt).

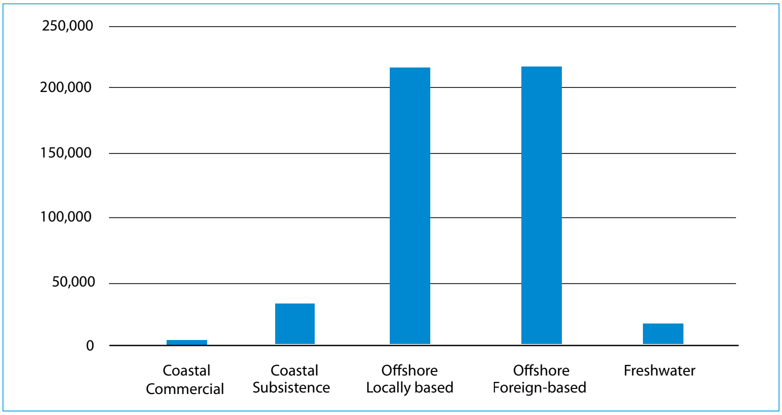


Figure 14-1: PNG Fisheries Production by Volume (mt), 2014

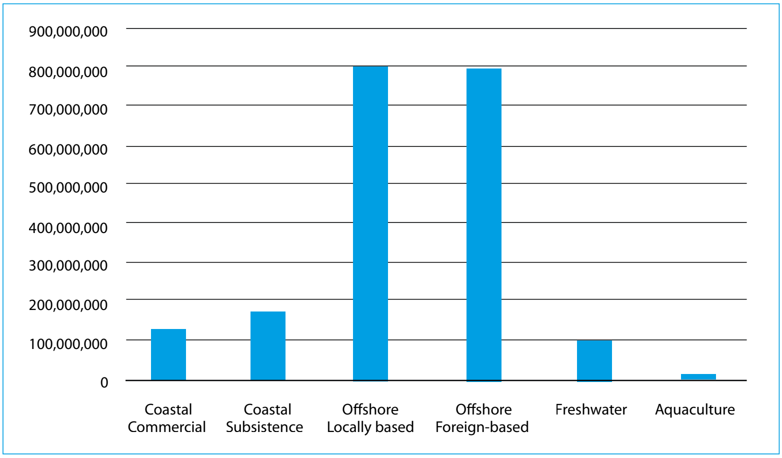


Figure 14-2: PNG Fisheries Production by Value (K), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for PNG from those three studies are provided in Table 14-7.[5]

Table 14-7: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, 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
Coastal Subsistence	1999	26,000	52,000,000
	2007	30,000	105,000,000
	2014	35,000	171,500,000
Offshore Locally based	1999	50,500	114,000,000
	2007	256,397	1,024,089,635
	2014	216,896	803,688,032
Offshore Foreign-based	1999	85,000	193,000,000
	2007	327,471	1,143,631,355
	2014	217,871	799,393,686
Freshwater	1999	n/a	n/a
	2007	17,500	49,000,000
	2014	20,000	98,000,000
Aquaculture	1999	n/a	n/a
	2007	200	2,000,000
	2014	145 mt and 160,000 pcs	3,156,700

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

The apparent changes in production for the three-year period represents a real change in production in some cases, but this can also represent a change in the methodology for measuring the production (hopefully an improvement). In the table above, the production levels for coastal commercial, coastal subsistence and freshwater increase slightly between the years. This is because there are no new data for those fisheries, but anecdotal information

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

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) are likely to reflect real changes in the amounts being harvested.

14.2 Contribution of Fishing to GDP

Current Official Contribution

Staff of the National Statistics Office (NSO) indicate that they have not calculated the PNG GDP for any year since 2006, due to several constraints. The NSO's activities related to GDP are currently focused on making an estimate for 2013. (H. Kari and D. Skutenko, per. com. August 2015)

The methodology for the 2006 GDP calculations was obtained from the NSO in 2008. (K. Geberi, per. com. September 2008) In the 1990s the NSO experienced difficulties in producing GDP estimates, and in the early 2000s the responsibility was transferred to the Bank of PNG. In the mid-2000s the NSO/BPNG methodology differences were reconciled, and accordingly the 2006 GDP estimates by NSO are considered the official estimates. These estimates are given in Table 14-8.

Table 14-8: The Official Fishing Contribution to GDP

	2002	2003	2004	2005	2006
Fishing: Market component	204.7	226.4	245.2	292.4	388.4
Fishing: Non-market component	55.5	60.8	63.2	65.8	68.4
Total Fishing	260.2	287.2	308.4	358.1	456.8
Total PNG GDP	11,872.0	13,241.5	13,459.4	15,094.7	16,896.6
Fishing as % of PNG GDP	2.2%	2.2%	2.3%	2.4%	2.7%

Notes: Current prices; units are millions of Kina
Source: National Statistics Office (unpublished data)

Method Used to Calculate the Official Fishing Contribution to GDP

In 2008 the staff of the NSO indicated that the general method used in most economic sectors to calculate GDP contribution is to take the gross output of production (GO), and reduce that value by intermediate consumption (IC), to determine the value added (VA) (i.e. GO–IC=VA). The fishing sector is partitioned into two components. To calculate the value added of "market fishing" the results of business surveys carried out in 1991, 1998 and 2004 are used, and extrapolated for future years on the basis of export data. For "non-market fishing", the study, Dimensions of PNG Village Agriculture (Allen et al. 1996) provides 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 "market fishing".

Staff of the International Monetary Fund's Pacific Financial Technical Assistance Centre, in Suva, indicated that 2006 is the last year for which PNG's NSO has estimated the country's GDP, however, other agencies have made estimates (R. Freeman, per. com. October 2014). NSO staff indicate that the Treasury Department has made "shadow" GDP estimates, but those would not include any treatment of fisheries. (H. Kari and D. Skutenko, per. com. August 2015) The International Monetary Fund (IMF 2015) estimates PNG's 2014 GDP to be US$16.8 billion (K43.2 billion).

Alternative Estimate of Fishing Contribution to GDP

Table 14-9, 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 14-6), 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).

It is not intended that the approach in Table 14-9 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 14-9: Fishing Contribution to GDP in 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production (K, from Table 14-6)	VAR	Value Added (K)
Coastal Commercial	130,000,000	0.65	84,500,000
Coastal Subsistence	171,500,000	0.90	54,350,000
Offshore Locally based			
Longline	10,229,587	0.20	2,045,917
Purse seine	793,458,445	0.50	396,729,223
Freshwater	98,000,000	0.95	93,100,000
Aquaculture	3,156,700	0.65	2,051,855
Total (K)	**1,206,344,732**	--	**732,776,995**

It is stated in this chapter, above, that there is not yet an official 2014 GDP for PNG. However, the IMF estimate of the 2014 PNG GDP is US$16.8 billion (K43.2 billion). Using that figure, the 2014 fishing contribution from the table (K732,776,995) is about 1.7% of the 2014 GDP.

The literature contains some misinformation about the contribution of fishing to the PNG GDP, as described below:

- ADB (2014) indicates the contribution of fishing to GDP was 3.4% in 2007, quoting Gillett (2009). The 2009 study did not estimate a 2007 contribution, but rather cited the official 2006 contribution of 2.7%.
- Martin (2015) states: "PNG witnessed significant growth in the fisheries sector due to political stability and GoPNG's focus and support on downstream processing through export led growth strategy thus increasing contribution from the fisheries sector from 3 - 5% of GDP". This is significantly higher than the Gillett (2009) estimated contribution (1.7%).

14.3 Exports of Fishery Production

The marine product exports of PNG are shown in Table 14-10. It can be seen that the nominal value has increased over the period 2007–2014.

Table 14-10: Value and Volume of Fishery Product Exports

	Value marine products (K millions)	Value all domestic exports (K millions)	Volume marine products (mt thousands)	Value marine products as % of domestic exports
2007	221.6	14,058.8	49.3	1.6%
2008	293.2	15,655.6	55.8	1.9%
2009	232.9	12,079.8	55.4	1.9%
2010	114.0	15,601.8	34.1	0.7%
2011	259.8	16,376.1	67.5	1.6%
2012	329.5	13,181.4	71.1	2.5%
2013	234.4	13,337.3	46.2	1.8%
2014	345.9	21,767.1	69.6	1.6%

Source: Website of Bank of Papua New Guinea (www.bankpng.gov.pg)

The information in the above table derives from the Customs Department. The National Fisheries Authority maintains an independent database of the exports of fishery products. Unfortunately, annual information by commodity is not readily available from that database, and summary information is not presented in a recent NFA annual report.

Several observers have commented that the NFA database yields higher values than the Customs database. For example, in an NFA paper (Usu et al. 2015) states that the value of tuna exports in 2014 was around US$218 million (K560 million), whereas the total marine product exports in 2014 in the table above is K345.9 million. A similar discrepancy was noted in the Gillett (2009) study, and more recently in a study sponsored by the European Union (Hamilton et al. 2011). Possible reasons for the discrepancies include differences in accounting for re-exports (tuna/mackerel imported for canning and later exported), and differential effectiveness in monitoring large volumes of export documentation.

PNG's most important fishery export commodity is tuna. A recent study examines the PNG tuna processors and their local and overseas markets. The summary results are shown in Table 14-11.

Table 14-11: Products and Markets of Tuna Processors in Papua New Guinea

	Products	Export Markets for Processed Products	Local/Regional Market
RD Tuna Processors	Canned tuna, primarily skipjack but some yellowfin Cooked loins – mostly yellowfin, but some skipjack fish meal	70% canned tuna to EU (Germany, UK, Netherlands, Denmark, others); private label; Chunks/ solid/flakes in oil/brine Cooked loins: EU (Spain, Italy), mostly yellowfin	30% canned tuna production sold mostly in PNG, some to Vanuatu, Solomon Islands. Own label, various grades including red meat
Frabelle Corp.	Canned tuna, primarily skipjack, but some yellowfin Cooked loins – mostly yellowfin, but some skipjack fish meal	80% canned tuna production to EU (Germany, UK, Netherlands, others); private label; Chunks/ solid/flakes in oil/brine; Cooked loins: EU (Spain, Italy) mostly YF	20% canned tuna production sold in PNG Own label; canned in oil, fancy packs, red meat
SSTC	Cooked loins: skipjack and yellowfin	98% of cooked loins to EU (Spain), Thailand. Small volume to US (Bumble Bee)	No local sales; Occasionally red meat shipped to other canners in PNG
IFC	Skipjack and some yellowfin	Not available	Not available, but believed to be very small
Majestic Seafoods	Canned tuna and loins	All exported to EU	Not available

Source: McCoy et al. (2015) and M. Brownjohn, (per. com. January 2016)

14.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

Information on access fees for foreign fishing is not readily available from NFA. A considerable amount of investigation was required to estimate the access fees. The available documentation was examined, presentations by NFA staff at international meetings were studied, and people knowledgeable about PNG access fees were interviewed, especially past employees of NFA, fishery consultants and staff of regional organisations involved in fisheries. The following features were examined: fees to PNG from the US tuna treaty, the number of vessel day scheme (VDS) days allocated to PNG, the distribution of days among various fleets, benchmark prices for those VDS days, information on reductions in fees for PNG-based fishing companies and other entities, provisions for fees for vessels operating under the FSM Arrangement, estimates of PNG access fees by other agencies, and news in the media on payments by NFA to the PNG government.

Using the above information types to estimate recent PNG access fees could easily lead to poor estimates, however, conversely, advancing an "educated" guess may encourage others to produce better assessments. Accordingly, it is estimated that the 2013 PNG access fees were US$44 million (K113.1 million), and the 2014 PNG access fees were US$85 million (K218.5 million).

The revenue and grants of the PNG government budget were K12,675 million in 2014 (Department of Treasury 2015). The 2014 access fees therefore equated to 1.7% of the revenue and grants for the year.

As mentioned above, offshore fishing in PNG in 2014 (and to some degree the associated access fees) was somewhat atypical. 2014 was an El Niño year, and purse seine catches characteristically move eastwards during El Niño periods (i.e. towards the Kiribati zone), and consequently the desirability of access to the PNG zone is reduced.

The NFA website[6] contains information about future access fees: "The revenues from access fees will decrease in the coming years as the government continue to promote onshore processing of our tuna resources. The benefits of onshore processing will be in the form of employment, tax returns and spin-off businesses."

Other Government Revenue from Fisheries

A limited quantity of information is available on government revenue from the fisheries sector, other than access fees. In the past the NFA annual reports gave the "domestic license fees received by NFA" and "other fees received by NFA".

The NFA Deputy Managing Director indicated that the tuna sector generates revenue from application fees, observer fees and training levies (L. Kumoru, per. com. August 2015).

A substantial amount of tuna transshipment occurs in PNG, and several other Pacific Island countries derive revenue by taxing transshipments. According to McCoy (2012), PNG does not charge transshipment fees, but harbour fees and cost recovery of monitoring services are applied. (M. Brownjohn, per.com. January 2016)

6 www.fisheries.gov.pg/FisheriesAuthority/NFAPaysK50MDividendPaymenttotheGovernment/tabid/335/Default.aspx

14.5 Fisheries-Related Employment

Three reports summarise the situation with respect to participation in the subsistence fisheries of the country. Although those studies use data from the 1990s, it is unlikely that the circumstances have changed significantly:

- UNDP (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.
- 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 fresh water 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%).”
- 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 at 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”.

Some of the above information has become institutionalised. For example, ADB (2014) indicates that, in PNG, 120,000 people are involved with capture fisheries (without source attribution). It appears that there has been no substantial research undertaken into participation in PNG subsistence fisheries at the national level for the past two decades. The readily available documentation from the latest national census (NSO 2012) does not contain the word “fish”. The most recent PNG household income and expenditure survey has not been analysed for fishery participation information.

SPC's ProcFish programme surveyed four sites in PNG (Friedman et al. 2008). Table 14-12 is an extract from the report of the survey showing the importance of both reef fisheries and the sale of fish. The ProcFish sites are not representative of all sites in PNG, but rather an attempt was made to choose sites that are typical of coastal locations with active marine fisheries.

Table 14-12: Involvement with Fisheries at the ProcFish Sites

Site	% Households involved in reef fisheries	% Households with fisheries as most important source of income
Andra	100	50.0
Tsoilaunung	100	50.0
Sideia	100	70.0
Panapompom	100	43.3
Average across the four sites	100	53.3

Source: Friedman et al. (2008)

The number of people employed in small-scale commercial fishing in PNG has never been adequately surveyed, and many of the current estimates are at least partially based on a UNDP fisheries sector study in the late 1980s. 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".

The corporate statement of the National Fisheries Authority (NFA 2015) mentions the employment that the NFA has helped create:

> Within the last 14 years, the National Fisheries Authority has accomplished fisheries development and infrastructures, impact projects, processing plants, aquaculture developments, research facility, capacity building and international fisheries cooperation/agreements. For the fisheries sector alone, this is a massive milestone achievement for Papua New Guinea, creating employment for more than 30,000 Papua New Guineans and providing income earning opportunities of nearly K10 million a year to ordinary Papua New Guineans.

The NFA itself provides direct employment. Govan et al. (2013) states: "The overall NFA Staffing stands at 170 and the National Fisheries College (NFC) stands at 22. There are 9 inshore Fisheries staff assigned in Port Moresby. A full staff structure is not available for NFA. Provincial Fisheries Offices have between 4 and 12 staff coming to a total of 77 staff in the 9 maritime provinces for which there are data". In addition, the fishery observer programmes employ about 350 people under contract to NFA.

The PNG tuna industry is a large employer, in both processing and fishing components. Box 14-3 summarises the tuna processing- employment situation.

Box 14-3: Employment in PNG Tuna Processing

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 underemployment 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 ton 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.

In July, 2014 a new minimum wage requirement became effective in PNG. The new rate is pegged at K3.20 (US$1.17 in March, 2015). It is estimated that total annual gross wages that will be paid under the new requirement is on the order of K35 million to K40 million (US$12.8 million to US$14.6 million).

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)

Other estimates of the number of jobs generated by the tuna industry are summarised below:

- The PNG submission to the 2015 meeting of the Scientific Committee of the WCPFC (Usu et al. 2015) stated: "Currently, the industry supports almost 7,000 people in direct employment and almost 2,000 indirect employments in the country of over 6 million people. New commitments and investments would triple these figures."
- Pokajam (2012) estimated there were 11,600 people directly employed in the four tuna processing plants that existed in 2012, plus an additional 34,800 indirect tuna-related jobs.
- An EU-sponsored study (Hamilton et al. 2011) estimated that tuna processing in 2010 provided 6,534 direct jobs and 16,335 indirect jobs.
- The Forum Fisheries Agency has an a project – Economic Indicators Programme – that collects data on tuna-related employment in standardised form: FFA (2015) contains information on the employment of people from PNG in the tuna industry (see Table 14-13). That document states a total of 9,312 people from PNG were employed in the tuna industry in 2014.

Table 14-13: Tuna-Related Employment in PNG (number of people employed)

	2009	2010	2011	2012	2013	2014
Processing and ancillary	5,783	5,600	5,962	6,640	7,000	7,536
Local crew	1,102	1,102	1,153	1,509	1,776	1,776
Total	**6,885**	**6,702**	**7,115**	**8,149**	**8,776**	**9,312**

Source: FFA (2015)

The above tuna-related employment can be viewed from both regional and national perspectives. Across the Pacific in 2014 a total of 17,663 people were employed as crew on tuna vessels or in tuna processing and ancillary work (FFA 2015). The tuna industry employment in PNG (about 9,315 people according to FFA) represents 52.7% of the regional tuna-related employment. Nationally, about 774,000 people in PNG have "monetary employment" (FAO 2011). Tuna-related employment therefore represents about 1.2% of the monetary employment in the country.

A study by the Asian Development Bank (ADB 2014) provides some insight into the role of women in fisheries and the associated challenges, as follows:

> In PNG, studies have shown that women's fishing efforts supply an estimated 20% to 50% of catches annually in some areas. Under the influence of the cash economy, women's position is being usurped through changing values and a breakdown of traditional social structures. Women are very much involved in harvesting, processing, and marketing but poorly represented at management levels or at meetings or planning processes. Because women do contribute significantly to the overall marine resources harvested, any attempt to develop a fishery or coastal resource management program will need participation of women as equal partners with men. With concern over depletion of inshore marine resources due to habitat loss and overharvesting, fisheries departments in the Pacific are encouraging offshore fisheries, for example by providing gear and training. Unfortunately, experience shows that women receive little or none of the benefits from such programs.

SPC (2013) uses ProcFish data to examine the ratio of men to women fishers across the Pacific. For the PNG sites examined, about 42% of fishers are men and 58% are women. PNG is one of the few countries in the ProcFish study where, at the sites examined, women represent more than half of fishers.

It appears that gender in the PNG tuna industry has received much attention. An FFA study (McCoy et al. 2011) quantified employment in tuna processing by sex and other attributes (Table 14-14).

Table 14-14: PNG Tuna Processing Summary Labour Profile, 2011

Attribute	Quantification
Total number of employees	6703
Total number of expatriate workers	151 (2%)
Total number of female employees	4911 (73%)
Percentage of PNG nationals in 73 management-level positions	18%
Percentage of PNG nationals in 272 supervisory positions	70.5%
Percentage of PNG nationals in unskilled positions	100%

Source: McCoy et al. (2015)

An SPC study on gender in the tuna industry (Sullivan and Ram-Bidesi 2008) 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. Further information from the study is given in Box 14-4.

Box 14-4: Women in the PNG Tuna Industry

The National Fisheries Authority (NFA) was established by the Fisheries Management Act of 1998 to replace the former Department of Fisheries and Marine Resources. Women are involved within the NFA in several types of roles, including surveillance, enforcement and monitoring. According to the Secretary to Corporate Services, there are 33 female employees at all levels in the NFA out of a total of 91 staff. Women have also found employment in fisheries related business administration and provide legal, scientific, and technical services to private and government fisheries institutions. There are no specific employment figures for such workers but the authors estimate no more than 1,000 women are employed in service industries related to the fisheries sector. This does not include the large number of PNG women involved in fish processing. The actual harvesting of tuna is largely a male domain in Papua New Guinea and there are no women currently working on commercial tuna vessels. The contribution of women to the tuna harvesting sector (purse seine, pump-boat and longliners) is therefore negligible, as very few actually handle fish at the ports, notably at RD Tuna's Vidar wharf. Women work in marketing fish at all levels, from roadside stalls to the export of tuna sashimi products. The potential for expanding women's roles in the industry is primarily in the processing and marketing stages, where diversifying value added strategies, expanding overseas markets, and enforcing gender equity legislation will produce more jobs for women. Greater credit opportunities, under relaxed criteria, will also bring more women into the industry.

The findings from this country study reveal that, whilst women have benefited from entry into the formal economy through the tuna industry, most of the opportunities exist primarily at the lower wage range in processing plants in Madang, Lae and Port Moresby. Because these jobs are in great demand, market forces have not resulted in the processing companies paying much attention to important health, safety, transport and wage concerns that prevail. This lack of current attention, and unlikely possibility of spontaneous improvement, appears to justify at least some government intervention to mitigate the problems.

Source: Sullivan and Ram-Bidesi (2008)

14.6 Levels of Fishery Resource Consumption

Preston (2001) summarises the earlier information on fish[7] 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

7 Preston (2001) uses the term "fish" to describe freshwater and marine finfish, shellfish and other aquatic food products.

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 63 million kina, 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 consumption8 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. (2009) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES 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 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).

SPC's ProcFish programme carried out survey work at four sites in PNG (Friedman et al. 2008). That work included estimations of per capita fish consumption. The results of this work are shown in Table 14-15.

8 Apparent consumption is the composite of domestic production (subsistence and commercial) plus imports, less exports.

Table 14-15: Fishery Product Consumption at ProcFish Sites (kg/person/year)

Village	Fresh fish consumption	Invertebrate consumption	Canned fish consumption
Andra	35.66	6.54	11.79
Tsoilaunung	35.11	11.28	6.88
Sideia	23.95	9.47	5.64
Panapompom	37.39	1.77	2.70
Average across the four sites	33.77	7.02	5.13

Source: Friedman et al. (2008)

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.
- Pilling et al. (2015) show that the non-target bycatch from offshore fishing in PNG amounts to 1,393 mt annually in the period 2008–2010. Nationally, this equates to a potential supply of 0.268 kg/person/year.
- ADB (2014), using FAO data, shows that in PNG fish provides about 6.9% of the total protein supply for the country.

The consumption of canned tuna in PNG is increasing. Table 14-16 (from Hamilton et al. 2011) shows the increase over a five-year period.

Table 14-16: The PNG Domestic Market for Canned Tuna, 2006–2010 (mt)

Year	Domestic Production	Imports	Total
2006	6,600	3,738	10,338
2007	7,800	5,056	12,856
2008	6,000	4,597	10,597
2009	7,500	3,609	11,109
2010	9,500	5,566	15,066

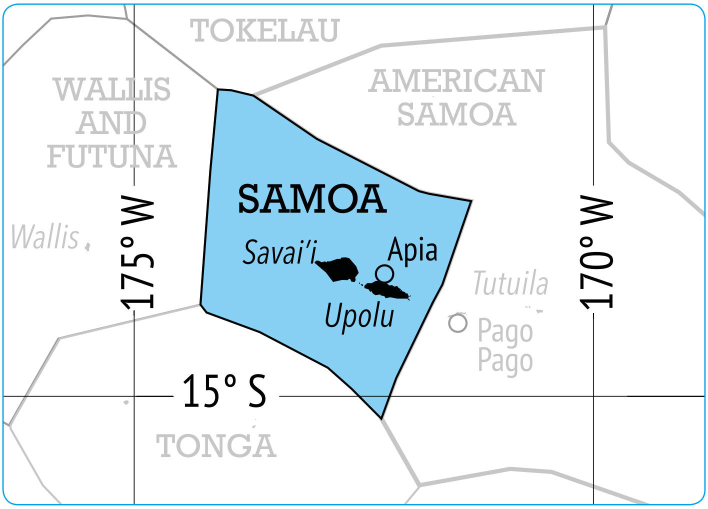
Source: Hamilton et al. (2011)

14.7 Exchange Rates

The average yearly exchange rates (PNG Kina (K) to the US dollar) used in this report are as follows:

2007	2008	2009	2010	2011	2012	2013	2014
2.96	2.77	2.65	2.63	2.13	2.07	2.42	2.57

15 Samoa



15.1 Volumes and Values of Fish Harvests in Samoa

The widespread use of "alia" catamaran fishing craft is unique to Samoa. Categorising Samoan fishing activity requires special attention. 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 report 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 to benefit from that effort, it is worthwhile recording the various surveys and associated results, with observations, as follows:

Mulipola et al. (2007) reviewed the history of those efforts to estimate catches:

- 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 mt, while inshore landings were estimated at 666 mt.
- In 1991 the Fisheries Division and FAO conducted the Inshore Resource Assessment Project. Originally 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 mt per year.
- In a 1997 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 mt 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 respondent's 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 tons, with a value of ST$45 million. A total of 2,876 tons was sold or given away, leaving 4,293 tons for home consumption.

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 mt (worth ST$19.9 million) and a coastal subsistence production of 4,293 mt (worth ST$ 21.6 million (Samoan Tala)).

The Samoan household income and expenditure survey (HIES) was carried out in 2002. Although the work was not fishery focused, the results of that work can be further analysed to provide considerable insight into coastal fisheries production in the country:

- The value of the annual coastal commercial catch was determined to be ST$30 million, and the value of annual coastal subsistence catch was ST$22.8 million.
- The value of annual commercial catch divided by a commercial fish price of ST$7.36/kg indicates 4,076 mt of commercial catch from coastal fisheries.
- The value of annual subsistence catch divided by a fish price of ST$5.13/kg indicates 4,437 mt of subsistence catch.
- In summary, the 2002 HIES coastal fisheries production estimated:
  Coastal commercial catch: 4,076 mt, worth ST$30 million
  Coastal subsistence catch: 4,437 mt, worth ST$22.8 million

In 2003 the Fisheries Division completed two one-week creel surveys in 112 villages nationwide (Mulipola 2003). The survey estimated 11,700 fishers in Samoa with total landings of 12,270 mt.

Mulipola et al. (2007) describe the results of the most recent fishery-focused study that estimated coastal fisheries production, summarised as follows:

- 939 households in 49 villages (26 on Upolu, 23 on Savaii) were interviewed about their household composition, income, education level, seafood purchasing and consumption habits, fishing preferences, catch, and whether they sell fish.
- The fisheries data collected through household surveys were validated through a creel census.
- On the basis of per capita fish consumption, the study determined that total annual landings were 13,686 mt, worth ST$84 million.

Gillett (2009) compared the results of the 2000 HIES to the 2000 fisheries survey with respect to fish production. After correcting for fish price changes between 2000 and 2002, for the coastal commercial component the HIES gives 50% more value and 32% more volume than the 2000 fisheries survey. For the coastal subsistence fisheries the volumes/values are very close in the two studies (3% and 5% respectively). Discussions with an HIES specialist employed at SPC (C. Ryan, per. com. November 2008) indicated that the major difference between the two studies was the method of obtaining information from respondents. The HIES used individual diaries filled out by respondents over a two-week period (the HIES staff were able to stay in the selected villages during the entire two-week diary-keeping period), while the

2000 fisheries survey used general recall (e.g. "What is the usual amount of seafood caught by people in your household in one week?").

In the Gillett (2009) study, a modification of the coastal commercial fishery production estimate of the HIES study was used. 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, as given in Fisheries Division (2008): ST$12.41 per kg. Accordingly, the 2007 production from Samoa's coastal commercial fisheries was estimated to be 4,129 mt, worth ST$51,240,890. Including the estimate of the subsistence component (methodology given below in the coastal subsistence fishing section), the total coastal catch was estimated to be 8,624 mt in 2007.

Since the Gillett (2009) study Samoa Fisheries carried out a fisheries socio-economic survey in 2012 (Box 15-1), and the Fisheries Division continued its regular market survey work (described below).

Box 15-1: The 2012 Samoa Socio-Economic Fisheries Survey

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 surveyed - 584 in Upolu and 297 in Savaii.

The objective of the survey was to gauge the status of fishing activities relative to the fisheries management and marine conservation programs at the village level and how these impact these fishing activities. Households were surveyed on their income and expenses, fishing activities methods and gears, catch usage (whether they are sold, given away or consumed) and post-harvest methods. Fishing activities were analysed in males and female groups and at the village level with respect to two different management programs.

The results of the survey showed that in 2012:

- The estimated total finfish catch was 9,066.32 mt/year, with an estimated value of ST$89 million. The estimated catch of invertebrates was 7,804.42 mt/year with an estimated value of WS$86 million in income generated.
- The total annual coastal catch (commercial/subsistence and finfish/invertebrates) was 16,870 mt.
- The average consumption per capita was 46.2kg/yr for finfish and invertebrates with 54.7kg/yr.
- Other important fishing activities such as fishing efforts, catch per unit effort, fishing sites and so forth were determined and reported.

Source: Tiitii et al. (2014)

Over many years the Fisheries Division has carried out a programme of regular surveys of the landings of inshore fisheries catch that are sold. These surveys are conducted at four main market outlets, such as Fugalei Agriculture market, Apia fish market and Salelologa fish market, in three sampling days randomly selected. Roadside sales were sampled once per week. The 2013/2014 Fisheries Division Annual Report (Fisheries Division 2014) gives the results for that fiscal year. The overall estimate of inshore landings of fishery products traded at the local market outlets was ST$1.3 million, with a volume of 113 metric tons during the fiscal year. An examination of Fisheries Division Annual reports shows that the total annual volume recorded by these Fisheries Division surveys has ranged from 110 mt to 136 mt since 2005.

Some observations can be made in comparing the results of the 2012 Samoa Socio-Economic Fisheries Survey (Box 15-1) and the regular outlet surveys, above:

- If it is assumed that the amount of commercial catch is approximately equal to the subsistence catch (as suggested by many of the previous surveys), then the socio-economic survey gives a coastal catch about 75 times greater than the outlet surveys.
- The volumes of total coastal catch estimated by both the socio-economic survey and the outlet surveys appear to be outliers among the many surveys of Samoa's coastal catches. In other words, the 226 mt of the outlet surveys[1] and the 16,870 mt of the socio-economic survey are very different from the 8,000 mt to 9,000 mt suggested by many of the previous surveys.

During the short period of the present survey (1.5 days in Apia) it was not possible to reconcile the irregularities noted above. It is possible, however, to provide thoughts on possible sources of the differences:

- It appears that the quantity of commercial fish given in the annual report actually refers to the amount of fish that was monitored, or alternatively the monitored fish was not adequately extrapolated to reflect all coastal commercial catches in Samoa.
- Discussions with staff of the Samoa Bureau of Statistics indicate that they have examined the results of the 2012 socioeconomic fisheries survey. They do not use the results in their macroeconomic work, as they feel that the survey was over-focussed on fishing communities and therefore was not representative of all of Samoa. Currently, they are using the results of the most recent HIES to estimate coastal fish production.

1 Assuming that the volume of commercial catch is about equal to the subsistence catch.

- On the other hand, according to Fisheries Division staff, non-coastal villages were purposely included in the socio-economic survey to eliminate a bias towards fishing communities – so the surveyed villages are, on that basis, representative of all Samoa.

Since the Gillett (2009) estimate of the 2007 production from Samoa's coastal commercial fisheries of 4,129 mt, worth ST$51,240,890, the following has occurred:

- The population of the country has increased by 3.3% (SPC's PRISM website data).
- The 2009 tsunami resulted in some destruction of fishing gear/boats, a reluctance by some people (at least temporarily) to fish in the ocean, and a relocation of some coastal villages.
- Some fishing gear/boats were destroyed in 2012 during tropical cyclone Evan.

With respect to prices paid to fishers for coastal finfish and invertebrates, discussions were held with the staff of the Fisheries Division, and fish prices in the annual reports were examined. For the purpose of the present study, the price of ST$8.50 is used. This is likely to more realistic than the price paid to fishers used in the Gillett (2009) study (ST$12.41/kg).

The present study deems the total catch from Samoa's coastal fisheries in 2014 to be 10,000 mt, with the coastal commercial fisheries in the country providing 5,000 mt, worth ST$42.5 million to fishers.

Coastal Subsistence Catches

Following the above discussion, it is estimated that coastal subsistence fisheries in Samoa in 2014 caught 5,000 mt of finfish and invertebrates. Taking 70% of the above commercial fish price (using the farm gate approach for valuing subsistence production) this was worth ST$29.75 million.

Locally Based Offshore Catches

Fisheries Division (2015) states that, in 2014, the locally based offshore fleet consisted of 42 longline vessels: 20 alia catamarans (under 11 m), 9 vessels from 11 m to 20.5 m, and 4 vessels greater than 20.5 m. All of the 2014 catch was made within the Samoa EEZ.

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries

Commission have been made by the Forum Fisheries Agency using data sourced from the Oceanic Fisheries Programme of the Pacific Community. The volumes and values can be determined using the "catch by national fleet" and "value by national fleet" spreadsheets of FFA (2015)(Table 15-1).

Table 15-1: Volume and Value of the Catch by the Locally Based Offshore Fleet

	2010	2011	2012	2013	2014
Volume tuna catch (mt)	3,090	1,932	2,352	2,020	1,091
Delivered value tuna catch (US$)	11,247,834	8,780,682	9,982,534	7,158,455	4,574,813
Volume catch adjusted for bycatch (mt)	3,553	2,221	2,704.8	2,323	1,254
Catch value adjusted[2] for delivery costs and value of bycatch (US$)	11,472,791	8,956,296	10,182,185	7,301,624	4,666,309

Source: FFA (2015)

The 2014 catch by Samoa's locally based offshore fleet was 1,254 mt, with an Apia dockside value of US$4,666,309 (or ST$11,152,478).

Foreign-Based Offshore Catches

In 2014 there were few, if any, foreign-based offshore catches in the Samoa EEZ. Fisheries Division (2015) shows no such catches, and FFA (2015) shows only a tiny amount.

Freshwater Catches

ADB (2008) reports that 2% of all households in Samoa engage in at least some fishing in inland rivers and lakes.

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 mt per year.

This 10 mt can be valued with the approach used above for coastal subsistence catches, which results in an annual value for freshwater catches of about ST$54,259.

2 The values from the FFA (2015) spreadsheet (tuna prices at destination ports) have been adjusted for transport charges, to arrive at Apia dockside prices, and adjusted for the value of the bycatch.

Aquaculture Harvests

Fisheries Division (2013) contains a summary of tilapia farms in Samoa and their estimated production for the last six years. For FY 2012/2013 1,220 kg of tilapia was produced, with a value of ST$6,100. The average annual yield during the six-year period was 1,817 kg, worth ST$9,086.

Fisheries Division (2014) states: "twenty new tilapia farms were established within the fiscal year including a community farm being reactivated. This increased the number of tilapia farms in Samoa from forty four[3] to sixty four… The new Marine Multispecies Hatchery in Toloa was opened on the 21st February, 2014. The facility included a laboratory, wet-lab, office, 3 cement raceways, water and air-blower systems, bedrooms and showering facilities. Two giant clam spawning were conducted within this fiscal year, however was unsuccessful due to bad weather stressing out the clams before they could spawn."

Fisheries Division staff indicated that, in 2014, about 12 mt of tilapia was produced. As the farm gate price was between ST$5 and ST$6 per kg, the annual production was worth about ST$66,000.

While Samoa has some culturing of tridacna, seagrapes, mudcrabs and prawns, the amounts produced and sold in 2014 were very small.

Summary of Harvests

A crude approximation of the annual volumes and values[4] of the fishery and aquaculture harvests in Samoa in 2014 can be made from the above sections (Table 15-2).

Table 15-2: Fisheries and Aquaculture Harvest in Samoa, 2014

Harvest Sector	Volume (mt)	Value (ST$)
Coastal Commercial	5,000	42,500,000
Coastal Subsistence	5,000	29,750,000
Offshore Locally based	1,254	11,152,478
Offshore Foreign-based	0	0
Freshwater	10	54,259
Aquaculture	12	66,000
Total	**11,276**	**83,522,737**

3 With the production 1,220 kg of tilapia in FY 2012/2013, the 44 farms produced an average of 27.7 kg of tilapia per farm during the year.

4 The values in the table are dockside/farm gate prices.

Figures 15-1 and 15-2 show the volumes and values of the 2014 Samoa fisheries production.

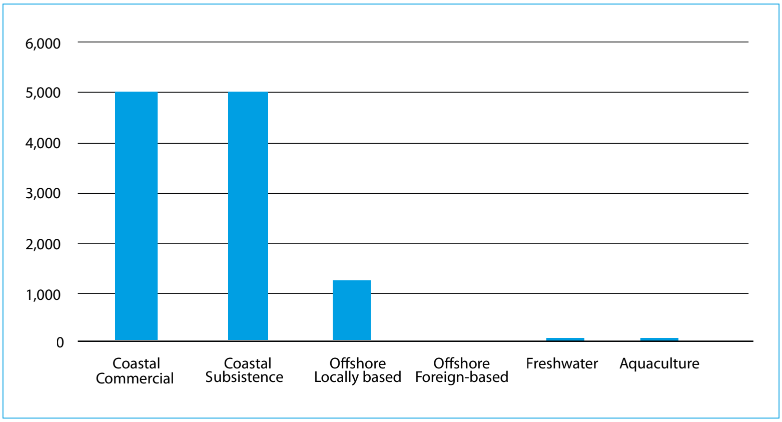


Figure 15-1: Samoa Fisheries Production by Volume (mt), 2014

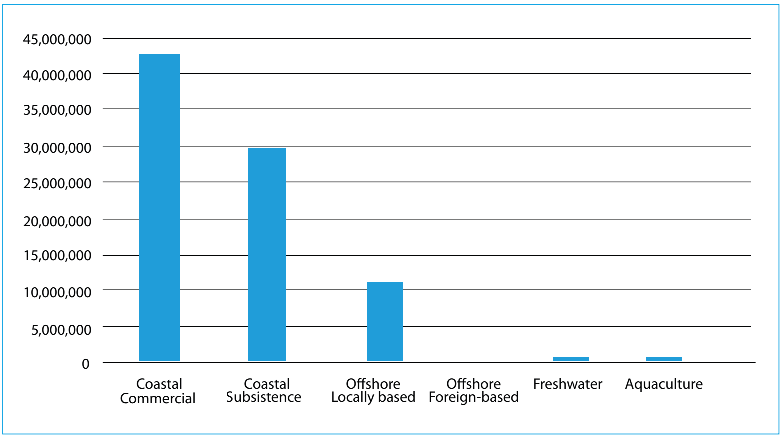


Figure 15-2: Samoa Fisheries Production by Value (ST$), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for Samoa from those three studies are provided in Table 15-3.[5]

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

Table 15-3: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, 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
Coastal Subsistence	1999	4,293	21,594,000
	2007	4,495	39,048,065
	2014	5,000	29,750,000
Offshore Locally based	1999	5,156	29,748,440
	2007	3,755	21,910,631
	2014	1,254	11,152,478
Offshore Foreign-based	1999	100	300,000
	2007	25	129,166
	2014	0	0
Freshwater	1999	n/a	n/a
	2007	10	87,000
	2014	10	54,259
Aquaculture	1999	n/a	n/a
	2007	12	66,000
	2014	10	87,000

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the production is measured (hopefully an improvement). In the table above, the production levels for 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) are likely to 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 Samoa Bureau of Statistics March 2015 Quarterly Report (SBS 2015), is given in Table 15-4.

Table 15-4: Official Contribution of Fishing to GDP

	2010	2011	2012	2013	2014
Fishing ('000s of ST$)	30,898	52,470	44,982	40,360	57,467
Samoa GDP ('000s of ST$)	1,689,968	1,824,699	1,834,409	1,859,661	1,922,057
Fishing as a % of GDP	6.5%	3.8%	4.5%	5.0%	3.5%

Source: SBS (2015)

Method Used to Calculate the Official Fishing Contribution to GDP

Staff of the Samoa Bureau of Statistics (A. Salani, per. com. September 2015) explained how the fishing contribution of GDP is calculated. The value added from fishing aggregates two components: monetary fishing and non-monetary fishing. Monetary fishing is comprised of:

- inshore catches that are sold;
- offshore tuna and other fish purchased and consumed;
- exports – tuna for canning;
- exports – air freight chilled; and
- all other fishery exports

The total of the value of the above five categories of monetary fishing is multiplied by a value added ratio of 0.85 to obtain the value added (equivalent to the contribution to GDP) for monetary fishing. For subsistence fishing the value of the subsistence catch is multiplied by a value added ratio of 0.95. The value of the subsistence catch is determined by the results of the most recent household income and expenditure survey, adjusted yearly.

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 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production ($ST, from table 15-2)	VAR	Value Added (ST$)
Coastal Commercial	42,500,000	0.80	34,000,000
Coastal Subsistence	29,750,000	0.90	26,775,000
Offshore Locally based [6]	11,152,478	0.40	4,460,991
Freshwater	54,259	0.90	48,833
Aquaculture	66,000	0.74	48,840
Total (ST$)	**83,522,737**	--	**65,333,664**

The total value added from fishing in Table 15-5 (ST$65,333,664) is 14% greater than the official estimate of ST$57,467,000. It is difficult to determine the source of the difference, because the specific amounts of the value added for monetary fishing and subsistence fishing in the official estimate are not readily available. However, it is likely that the inshore commercial catches and subsistence catches in the official estimate are smaller than those in the recalculated estimate, because they come from the HIES rather than from the fisheries surveys.

The total value added from fishing in Table 15-5 (ST$65,333,664) for 2014 is less than that calculated in the Gillett (2009) study (ST$85,042,903) for 2014. This stems both from changes in the fisheries and from changes in methodology. Offshore fishing dropped considerably between those years (the 2014 catch was one-third of the 2007 catch). In 2014 better information was available for prices of coastal fisheries products.

15.3 Exports of Fishery Production

The Quarterly Merchandise Trade report for March 2015 (SBS 2015) gives Samoa's fish exports and total exports (Table 15-6). It can be seen that the fish exports of the country are declining, in both relative and absolute terms.

6 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 were 0.38.

Table 15-6: Value of Fishery Product Exports (ST$ thousands)

	2012	2013	2014
Fish exports (ST$ thousands)	18,189	10,740	5,562
Total exports (ST$ thousands)	176,428	144,103	117,400
Fish as a% of all exports	10.3%	7.5%	4.7%

Source SBS (2015)

The Fisheries Division Annual Report 2013/2014 (Fisheries Division 2014) gives fish exports for a slightly different period: the fiscal year from 1 July 2013 to 30 June 2014. The report states: "Fish exported this fiscal year was estimated to be 1,035 metric tons valued at about 7million tala".

The Customs Department, the Central Bank of Samoa and the Fisheries Division all record the fishery exports of Samoa. Because the information for each of the three agencies comes from the same document the amounts recorded by each agency should be identical. In practice, they are all slightly different. This is probably because of the difficulties associated with compiling summaries from a large number of export documents.

According to Fisheries Division staff, export bans on several types of fishery products (coral, aquarium fish and beche de mer) that started in 1997 have resulted in almost all commercial fishery exports in recent years being tuna products.

15.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

In 2014 the only authorised foreign fishing in the Samoa zone was by vessels covered by the US Tuna Treaty. Despite that there was no fishing by that fleet in Samoan waters in 2014, the country nonetheless received a payment under the treaty's licensing arrangements. According to FFA staff, for the 26th licensing period of the treaty (the one-year period ending June 14, 2014), Samoa received US$555,815 (ST$1,328,395) as its share of treaty money that is divided equally amongst the treaty parties.

The total revenue of the Samoa government for the fiscal year ending 30 June 2014 was ST$473.6 million (ADB 2015). Therefore the ST$1,328,395 in access fees is equivalent to 0.3% of the total revenue of the Samoa government for that year.

Other Government Revenue from Fisheries

Apart from access fees for foreign fishing, the other major source of government revenue from fisheries is from licensing of domestic fishing vessels. In FY 2013/2014 ST$89,400 was collected from the 64 longliners based in Samoa. The fees range from ST$200 for vessels under 11 m to ST$10,000 for vessels over 20.5 m. (Fisheries Division 2014)

The government also receives money from licensing fisheries processing establishments (ST$1,050 per licence), export certificates (ST$5 to ST$10 per certificate; ST$$2,279 collected during the FY), market table renting (ST$10 per day), the sale of ice, and transshipment (ST$0.10 per kg). The total amount of money collected for most of these items for FY 2013/2014 is not readily available from the Fisheries Division.

15.5 Fisheries-Related Employment

A socio-economic fisheries survey was carried out in June and July 2012 (Tiitii et al. 2014). The survey was implemented in 100 villages (about 30% of the total villages in Samoa), and 881 households were surveyed. Some of the results of the survey are relevant to fisheries-related employment. Overall, the survey found that fishing is third, to agriculture and paid salary, in terms of income source. Nonetheless, fishing remains an extremely important source of household income for the village households under study. On average, 14% of all households ranked fishing as their first source of household income; the average for coastal communities was higher, at 18%. Fishing was ranked as the second-most important source of income for 8.5% of all households on average. The report of the survey contained a considerable amount of information on the gender aspects of fishing (Box 15-2).

Box 15-2: Gender Aspects of Coastal Fishing in Samoa

Male and female fishers are mainly commercially oriented for finfish. All fishers target mostly coastal reef and lagoon habitats, and only men fish for pelagic fish or in the open seas and mangrove areas; there are a few women, however, who fish on the outer reefs. For invertebrates, women target mostly soft bottom species, while men mainly glean and dive for clams, octopus, lobster, mother of pearl, and beche-de-mer, and equally target reef tops and mangrove areas. Most fishers go out exclusively during the day, while the rest fish both night and day, depending on tidal and weather conditions. Reef gleaning is performed only during the day by both men and women while some diving for invertebrates such as lobsters, trochus, giant clams, sea cucumbers is performed at night. Boats are used mainly by men when diving and/or gleaning, especially for sea cucumbers, trochus, turban shells and seagrapes, while few women use boats when they glean. Both men and women fish around three times per week, with men fishing for an average of four hours and catching (on average) 13.7 kg per fishing trip, and women fishing for an average of five hours and catching (on average) 10 kg per fishing trip. Men fish about 10 months out of the year, and women fish for about 9 months out of the year. About 86% of male fishers and 91% of female fishers used one technique per fishing trip. Catch per unit of effort for men is 4.3 kg/hour and for women it is 2.22 kg/hour. The frequency of fishing for men diving for invertebrates is five times per week for an average of three hours per fishing trip, over 10 months of the year. Gleaning takes place three times per week, for an average of three hours per fishing trip over seven months of the year. Women, on the other hand, spend three hours diving for invertebrates four times per week, for an average of nine months out of the year. Women glean two times per week, for an average of 2.5 hours over seven months of the year.

Source: Tiitii et al. (2014)

A labour force survey was carried out in Samoa in 2012 (SBS 2012). The survey was designed to cover 10% of households in both urban and rural areas. Although the usefulness of the survey for fisheries purposes is limited by the fact that the report mostly uses the combined category "agriculture forestry and fishery workers", some of the results are relevant to fisheries. The survey determined that the working age population of Samoa is 117,487, of which 67,186 are involved in subsistence activities. The relative importance of fishing activities are given in Table 15-7. Of the working age population, 6.7% are involved in subsistence fishing. The report of the Labour Force Survey also indicated that, of the 7,880 people that are involved in subsistence fishing, 95.3% live in rural areas.

Table 15-7: Importance of Various Types of Subsistence Activities

Type of activity	Total people	Male		Female	
Farm production	50,883	34,837	68.5%	16,047	31.5%
Look after animals	32,030	19,438	60.7%	12,592	39.3%
Construction/ repair work	4,406	2,959	67.2%	1,447	32.8%
Catch fish	7,880	6,018	76.4%	1,862	23.6%
Fetch water/ collect firewood	22,556	13,446	59.6%	9,110	40.4%
Produce clothing, furniture	2,641	673	25.5%	1,967	64.5%

Source: SBS (2012)

An agricultural census was conducted in Samoa in 2009 as a joint exercise of the Samoa Bureau of Statistics and the Ministry of Agriculture and Fisheries (SBS 2012). The 2009 census aimed to measure household agricultural activity, and was able to compare results with a previous agriculture census in 1999. Some of the fisheries-relevant results of that survey are described below:

- The total number of households engaged in fishing during the reference period was 5,752. Of these, 63% of households engaged in fishing reside in Upolu, and 37% reside in Savaii. Samoa's vulnerability to abnormal weather patterns, coupled with the devastating tsunami in 2009, are likely to be contributing factors to the significant drop of 14% in the total number of households engaged in fishing activities since 1999. Overall, the total number of households engaged in fishing fell by 5,132, or 47 percentage points, over the two decades.

- The main purpose of engaging in fishing was for home consumption only. However, some households also occasionally sold some of their catch. As reported in 2009, only 146 households (2.5%) of 5,752 fished mainly for commercial purposes: 1,842 (32%) occasionally sold and the majority – 3,764 (65%) – engaged in fishing for household consumption only.

- Fishing appears to have grown as a minor source of income, in comparing 2009 with 1999. In 2009, 39% of fishing households sold some or all of their catch, compared with 33% in 1999. In 2009, 14% of households engaged in fishing reported having sold about one-quarter of their fish catch, 12% sold about half, 10% sold three-quarters and 2.2% sold all of their catch

- On average, two members of each fishing household engaged in fishing in 1999 and 2009. There were more males (81%) than females (19%) involved in fishing activities in 2009. However there was an increase in the number of females engaged in fishing of 28% between 1999 and 2009, while the number of males engaged in fishing fell. This trend is consistent across the regions, except in Apia, where both the number and proportion of females engaged in fishing has fallen.

Examination of the results of an earlier fisheries survey is useful for comparison purposes. Mulipola et al. (2007) is a report of a survey conducted to assess the socio-economic status of rural villages with regard to fishing practices. Some of the results that are relevant to employment are summarised below:

- Although only 7.26% of the population are fishers, 41.7% of households have at least one fisher. Extrapolated to the population of Samoa, there are approximately 12,844 fishers in Samoa.
- With respect to the relative importance of income sources, over 60% of households received regular remittances from relatives overseas. Over 50% of households have a member earning income from a wage paying or salaried job. About 23% of households reported an income from fishing.
- In households with fishing incomes, fishing contributed an average of 41% to the total household income.
- Traditionally, women's fishing roles has been limited to gleaning shellfish or sea cucumbers in shallow areas along the shore. However, there seems to have been a sharp decline in the relative number of female fishers, from 18% in 1991 and 1997 to 13.5% now. Respondents suggested that it is more difficult to find the organisms nowadays compared to previous years.

McCoy et al. (2015) summarises the various reports on tuna-related employment in Samoa:

> Gillett (2009) estimated a total of 295 people employed in Samoa's tuna fisheries, with about 86% from local jobs on vessels and the remaining 14% from local jobs in shore facilities. FFA (2014) places the number of people employed in 2013 in processing and ancillary jobs at 33, and the number of local crew at 220. Crewing numbers have gone down in each of the three years preceding 2013 when a high of 307 was recorded. In 2015 some additional processing jobs will likely be created with the opening

of the longline receiving and packing facility at the main wharf. The number of people employed onboard vessels is likely to be somewhat less in 2015 due to fewer alias engaged in the longline fishery. An earlier report, Hamilton (2007) estimated the number of jobs per catch for alias and the large longliners. The author's conclusion was that the alias provided 16 jobs for every 100 mt of catch, while the large longliners resulted in just 5 employees for the same amount of catch. Of the 11 large longliners in operation in February, 2015, seven had Samoan captains while four were captained by expatriates. Most of the expatriates have been in Samoa for a long time, some arriving with the vessels 10 to 15 years earlier and now have family ties to Samoa and are resident in the country.

15.6 Levels of Fishery Resource Consumption

Table 15-8, below, summarises recent estimates of fish consumption in Samoa. It can be seen 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

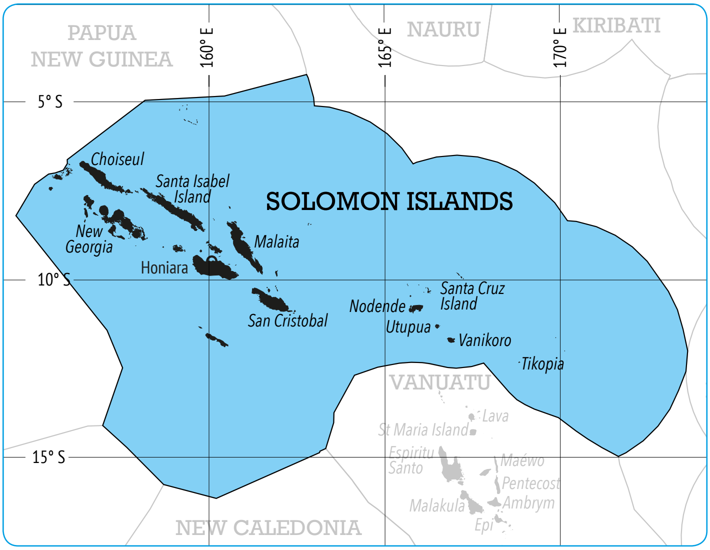
Source	Year for estimate	Estimate	Comments
Tiitii et al. (2014)	2012	Finfish: Annual per capita consumption is 46.15 kg/ year Invertebrates: Annual consumption is 54.74 kg/ year Canned fish: Annual consumption is 28.61 kg/year	The report contains the note: "Invert consumption refers to whole fish equivalent. For example, for giant clams, includes weight of shells"
Bell et al. (2009)	2001 to 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: • average frequency of consumption of finfish = 2.8 per days/week, invertebrates = 0.8 days/ week • average per capita consumption per year = 59.4 kg, (163g/ day) • total consumption per year = 10,508 mt (7,900 mt for Upolu, 2,608 mt for Savaii) Tinned fish: • average frequency of consumption = 4.5 days/ week • average per capita consumption = 73 kg/year (206 g/person/day) • 8,120 mt of tinned fish consumed per year in Samoa	Based on asking people to estimate their usual catch 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 report are as follows:

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
2.78	2.71	2.78	2.62	2.52	2.50	2.35	2.36	2.28	2.33	2.39

16 Solomon Islands



16.1 Volumes and Values of Fish Harvests in Solomon Islands

Coastal Commercial Catches in Solomon Islands

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 mt (US$4,343,811), and coastal subsistence production as 10,000 mt (US$8,405,660).
- Gillett and Lightfoot (2001) considered six sources of information on coastal commercial fisheries production in the period 1988 to 2000,

and ventured an annual estimate of 3,200 mt (worth SI$9,200,000 [Solomon Islands dollars]). They estimated coastal subsistence production of 13,000 mt (worth SI$39,000).

- Gillett (2009) considered the above estimates, and partitioned coastal commercial fishing in the country into three components: (1) local sales for domestic consumption: about 1,500 mt, worth about SI$12 million annually to fishers for the years 2005 to 2007; (2) baitfish: about 800 mt, worth SI$0.8 million annually to the recipient communities for 2005 to 2007; and (3) exports: about 950 mt, worth SI$12.5 million annually to fishers for the years 2005 to 2007. Total production and value for coastal commercial fishing for 2007 was estimated to be 3,250 mt, worth SI$25,300,000.

In an 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 SPC's ProcFish programme. (Pinca et al. 2009) The commercial production estimated by this study is almost three times higher than that of the Gillett (2009) study.

Green et al. (2006) summarise the structure of coastal commercial fisheries in Solomon Islands, as follows:

> 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.

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. (S. Lindsay, per. com. January 2016).

In addition to the above types of coastal commercial fishing, there is an inshore fishery for baitfish for Soltai pole-and-line tuna vessels.

In this section attempts are made to estimate the three components of coastal commercial fishing.

Inshore baitfishery: About 32.5 mt of bait would have been caught in coastal areas to produce the 650 mt of tuna caught by pole-and-line vessels in 2014. At SI$1 per kg (F. Wickham, per. com. August 2015) that would be worth SI$32,500 to fishers.

The exported coastal fishery products are provided in the export section, below, and summarised in Table 16-1. About 1,435 mt of products (worth SI$15.9 million) were exported during 2014. Those prices are presumably free-on-board (FOB) prices, which should be discounted to give prices paid to fishers. A discount of 50% is applied (based on a general understanding of associated costs), to give a value of SI$8 million to fishers. However: (1) fishery exports are taxed, giving an incentive to under report (especially values); and (2) there is some inconsistency between the Ministry of Fisheries and Marine Resources (MFMR) data given in the export section and other sources of information on fishery exports.[1] These features detract from the credibility of the estimate of the volumes/values of exported coastal fishery products.

Table 16-1: Exports of Coastal Fishery Products

	2012	2013	2014
Kg	1,176,737	1,739,405	1,434,627
SI$	15,972,246	32,420,862	15,868,698

Source: Table 16-9, below

Estimating domestically consumed coastal commercial fishery products is difficult. In the Gillett (2009) study a heterogeneous array of (often conflicting) observations and results from several studies were selectively used to make an educated "guess" of fish sales for domestic consumption: about 1,500 mt, worth about SI$12 million annually to fishers for the years 2005 to 2007. Since that study some conditions have changed and some additional sources of information have become available, including the following:

- Growth of the "salt fish" trade in Honiara. 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 mt of fish annually on the Honiara market. This is likely to reduce, to some extent, demand in Honiara for coastal fish.

1 For example, Pakoa (2014) states that 305 mt of beche-de-mer was exported from Solomon Islands in 2013, at a total export value of SI$33 million. The 2013 BDM exports given in the export section, below, indicate 160 mt, valued at SI$16.2 million.

- Increased over-exploitation of fishery resources targeted by coastal commercial fishing. There are many studies that point to this problem: Aswani and Sabetian (2009), Brewer et al. (2009) and Albert et al. (2015). This phenomenon is likely to reduce the flow of fish to domestic markets.
- Perceptions by Honiara fish sellers of the change in domestic fish trade. Nearly half of respondents (47%) indicated that they noticed a decrease in the amount of fish landed during the last five years, with Western Province (29.8%) and Malaita Province (25.5%) the two provinces where this has been most pronounced. Conversely, 45% of respondents noticed an increase in the amount of fish landed during the last five years, and this was most pronounced on Central Island. (Pomeroy and Di Yang 2014)
- Estimates of market sizes. Honiara Central Market (the largest market in Solomon Islands) represented 70.5% of all Honiara fish sales. (Pomeroy and Di Yang, 2014) Based on the Lindley (2007) estimate of 245 mt sold annually in the Honiara Central Market,[2] this equates to annual sales of 348 mt in all Honiara markets.
- Increasing national population. The number of people in Solomon Islands has expanded by 19.1% between 2007 and 2014 (Table 3-1).
- Increasing population of the major centres, especially Honiara, Gizo, and Auki. This would tend to increase the demand for commercial fish in those areas. The 2009 census shows that the urban areas are growing at an annual rate of 4%, while the population growth rate in rural areas is 1.8%. (NSO 2010)
- Additional information that could elucidate domestic sales of coastal fishery products has become available, including the ProcFish results from four villages and the 2009 national census.

The IUCN study mentioned above (Arena et al. 2015) represents an advance in estimating coastal fisheries production (both commercial and subsistence) in Solomon Islands. The study uses ProcFish data at four villages in Solomon Islands (Pinca et al. 2006) 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/yr). As the 2009 census has the number of households catching fish by frequency and by province, the IUCN study used the census data to produce estimates of coastal fisheries production by province. ProcFish data are used to partition the catches between subsistence (59% of all the catch) and commercial (41%). The major implication of the study is that coastal

2 The Honiara market does not allow the sale of "salt fish" (McCoy 2013).

fisheries in the country are producing substantially more fish than previous studies have suggested.

The methodology used by the IUCN census appears to be more rigorous than that of the previous studies, and its use should be encouraged. That approach, however, is highly dependent on the four ProcFish villages being representative of the entire country, and the assumption that the annual fish catches per category of household fishing frequency (e.g. that a household that fishes more than once a week catches 1,270 kg/yr) is applicable to the entire country. Through closely examining the report of the ProcFish study, considering how representative the four villages are of the national situation, and corresponding with former ProcFish staff, it appears that the fish production rate from the four villages is higher than the national average. Other relevant considerations include the following:

- The annual fish consumption at each of those villages (all around 100 kg/person) is much greater than reported in the eight previous national fish consumption surveys, discussed in the fish consumption section below. In fact the 106.78 kg/person/yr average of those four villages ranges from two to four times the consumption given in those studies.
- One of the reasons the ProcFish villages were chosen was that "they had active reef fisheries" (Pinca et al. 2009), which is unlikely be representative of the entire country.
- The assumption that annual production of fish per category of household fishing frequency (e.g. fishing once per week) from those four villages is generally applicable across the country is unlikely to hold. In this regard, about 20% of the population of Solomon Islands lives in urban areas, and larger islands have inland communities. Fishing near urban areas and in streams and lakes is not likely to be as productive as fishing in the vicinities of the four ProcFish villages.

The report of the IUCN study does acknowledge that the sample villages may result in an overestimate of the national average catch, and that the actual catch lies somewhere between the results of the Gillett (2009) study and the IUCN study, "most likely closer to the upper end of this range." The present study is in general agreement with the range of that statement and, as indicated above, the use of the IUCN approach should be encouraged, with additional attention given to obtaining data from a larger number of villages that are representative of the national situation.

The Gillett (2009) study gives annual coastal commercial catch for the mid-2000s in Solomon Islands of 3,250 mt, worth SI$25.3 million to fishers. This includes 1,500 mt of coastal fishery products for domestic consumption, worth SI$12 million to fishers. The IUCN study estimates, for 2013, the commercial reef finfish and invertebrate catch (22,369 mt annually), and the values of the beche-de-mer, trochus and aquarium trade. The values are not directly comparable, as the Gillett (2009) study uses prices paid to fishers in the range around the mid-SI$200s, while the IUCN study uses net annual values (added value for the domestic fish trade, and gross value for the export trade). As both studies use MFMR data for the volumes of exported coastal fishery products (albeit using some different amounts), the substantive obvious difference between the studies is in the volumes of the coastal fishery products for domestic consumption.

Currently, there is insufficient information available to make a definitive statement on the likely level of catches, in 2014, of coastal products for domestic consumption, other than to indicate they are likely to be between 1,800 mt (the Gillett (2009) estimate expanded by population increase) and 22,369 mt (IUCN study). Based on the reasoning given in this section, the present study suggests that the actual catches are most likely to be closer to the lower end of this range.

Prices paid to fishers in the villages and in various markets were derived from the literature (e.g. Brewer 2011; Pomeroy and Yang 2014) and from discussions with staff of the MFMR (B. Buga, S. Lindsay, per. com. August 2015). It was decided that an appropriate price for this study would be SI$18 per kg.

For the purpose of this book the 2014 coastal commercial catch in Solomon Islands is taken to be 6,468 mt, worth SI$98,032,500 to fishers. This consists of the following components:

- Baitfish: 32.5 mt, worth SI$32,500
- Exported coastal fishery products: 1,435 mt, worth SI$8 million[3]
- Domestically consumed coastal commercial fishery products: 5,000 mt, worth SI$90 million

Coastal Subsistence Catches

Many of the estimates of coastal subsistence fisheries production in Solomon Islands can be traced to one of two statements:

3 The annual value of exported coastal fishery products is greatly influenced by beche de mer. In contrast with 2013, in 2014 little, if any, beche de mer was legally exported.

- 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 sub-stations. 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 34.4kg/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."

The World Bank (2000) estimates that subsistence fishery production in Solomon Islands consists of 8,817 mt of finfish and 4,747 mt of shellfish, for a total production of 13,564 mt. Gillett and Lightfoot (2001) venture an estimate of 13,000 mt, worth SI$39 million. Gillett (2009) estimates, for 2007, a catch of 15,000 mt, worth SI$84 million. The IUCN study (Arena et al. 2015) gives a total subsistence catch for the country of 33,561 mt.

If the Gillett (2009) catch estimate is expanded by population growth in the period 2007– 2014, the result is 17,865 mt. Accordingly, recent estimates for the subsistence catch in the country range from 17,865 to 33,561 mt. For reasons advanced in the section on coastal commercial catches, above, the present study considers that the actual catches are likely to fall in the lower end of this range. However, these estimates are necessarily based on informed guesswork.

For the purpose of this study the 2014 coastal subsistence catch in Solomon Islands in 2014 is taken to be 20,000 mt. Using the "farm gate" system of valuing subsistence production (Bain 1996), which discounts the average fish price in the market by 30 percent as an allowance for getting the product to market, this production of 20,000 mt in 2014 can be valued by using the average rural buying price of SI$18 per kg, given above. This results in a value of SI$252 million.

Locally Based Offshore Catches

The domestic fleet in 2014 consisted of purse seine vessels and pole-and-line vessels (MFMR 2015; E. Honiwala, per. com. August 2015).

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries Commission have been made by the Forum Fisheries Agency using data sourced from the Oceanic Fisheries Programme of the Pacific Community. The volumes and values[4] can be determined using the "catch by national fleet" and "value by national fleet" spreadsheets of FFA (2015) (Table 16-2).

Table 16-2: Volumes and Values of the Tuna Catch by the Solomon Islands Domestic Fleet

	2010	2011	2012	2013	2014
Volume of national purse seine catch (mt)	12,965	25,561	26,500	24,769	40,874
Value of national purse seine catch (US$)	14,764,414	39,666,717	49,987,179	45,308,815	56,538,410
Volume of national pole-and-line catch (mt)	-	871	2,135	1,666	649
Value of national pole-and-line catch (US$)	-	1303927	3908932	2988541	834575.1

For 2014 the combined purse seine and pole-and-line catch of 41,523 mt was worth US$57,520,263 (SI$438,879,607).

Foreign-Based Offshore Catches

FFA (2015) can be used to estimate the volumes and values of the foreign tuna fleet catches in Solomon Islands waters (Table 16-3).

Table 16-3: Volumes and Values of the Catch by Foreign Tuna Fleets

	2010	2011	2012	2013	2014
Total volume in national waters (mt)	195,995	173,482	95,523	127,993	107,999
National fleet volume in national waters (mt)	26,907	28,192	28,635	26,418	71,425
Foreign fleet volume in national waters (mt)	169,087.79	145,289	66,888	101,574	36,573
Total value in National waters (US$)	388,656,357	377,391,745	291,167,750	309,980,334	322,210,525
National fleet value in national waters (US$)	80,265,435	57,113,221	63,407,189	56,785,179	229,000,668
Foreign fleet value in national waters (US$)	308,390,921	320,278,524	227,760,561	253,195,155	93,209,856
Foreign fleet value in national waters adjusted for bycatch sales and transshipment costs (US$)	262,132,283	272,236,745	193,596,477	215,215,882	79,228,378

4 The values from the FFA (2015) spreadsheet have been reduced by 15% to adjust the Bangkok price to a Solomon Islands dockside price.

In 2014 the volume of catches by foreign tuna vessels in Solomon Islands waters was 36,573 mt, with a Solomon Islands dockside value of US$79,228,378 (SI$604,512,524).

2014 does not appear to be a typical year for foreign-based offshore fishing in the Solomon Islands zone. 2014 was a strong El Niño year, and in El Niño periods purse seine catches characteristically move eastwards from PNG and Solomon Islands, towards Kiribati, Tuvalu and Tokelau.

Freshwater Catches

The many large islands in the country result in a relatively large 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 is deemed to be 2,300 mt, with a farm gate value of SI$29 million.

Aquaculture Harvests

At present, aquaculture is limited to mariculture activities in seaweed and some culture for the marine ornamental trade. There was a small amount of prawn (Macrobrachium and penaeid prawn) production in the 1980s and 1990s, but farms have since been inactive.

The production of seaweed is given in Table 16-4. Values given are farm gate prices.

Table 16-4: Solomon Islands Seaweed Production

Year	Weight (Ton)	Value (SI$)	Year	Weight (Ton)	Value (SI$)
2004	213.9	106,947.75	**2010**	888.0	3,244,032.00
2005	326.1	306,900.30	**2011**	902.2	2,323,763.63
2006	169.2	156,995.05	**2012**	873.8	3,191,128.40
2007	108.2	138,892.75	**2013**	1476.5	5,167,868.50
2008	144.9	419,107.50	**2014**	1520.3	5,611,457.96
2009	503.6	1,643,787.80			

Source: MFMR (unpublished data)

The CITES export database contains some information on the export of live (presumably cultured) coral.[5] It indicates that there were 20,947 pieces of live coral exported in 2013. Arena et al. (2015) shows that the annual value of live coral exports in the period 2007–2011 ranged from about SI$180,000 to SI$400,000. For the purpose of this study it is assumed that, in 2014, 20,000 pieces of cultured coral were harvested, worth SI$176,000 at the farm gate.

There are reports of minor amounts of other types of aquaculture activities in 2014, including tilapia, milkfish, giant clams and freshwater prawns.

It is estimated that aquaculture production of Solomon Islands in 2014 was 1,530 mt, plus 20,000 pieces, worth SI$5.9 million at the farm gate.

Summary of Harvests

A crude approximation of the annual volumes and values of fishery and aquaculture production in 2014 can be advanced (Table 16-5).

Table 16-5: Annual Fisheries and Aquaculture Harvest in Solomon Islands, 2014

Harvest Sector	Volume (mt, and pcs where indicated)	Value (SI$)
Coastal Commercial	6,468	98,032,500
Coastal Subsistence	20,000	252,000,000
Offshore Locally based	41,523	438,879,607
Offshore Foreign-based	36,573	604,512,524
Freshwater	2,300	29,000,000
Aquaculture	20,000 pieces and 1,530 mt	5,900,000
Total	**20,000 pieces and 108,394**	**1,428,324,631**

5 It is possible that a substantial proportion of this is actually wild-harvested coral (S. Lindsay, per. com. January 2016).

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 the 2014 Solomon Islands fisheries production. Aquaculture is not shown on the volumes figure due to the use of mixed units (pieces and mt).

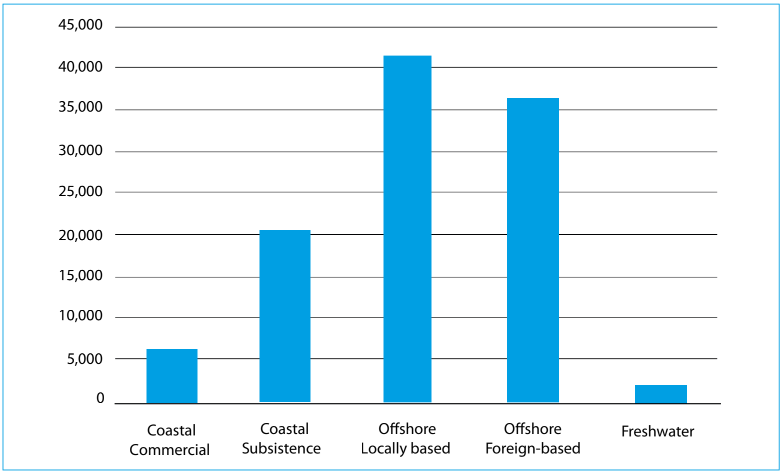


Figure 16-1 : Solomon Islands Fisheries Production by Volume (mt), 2014

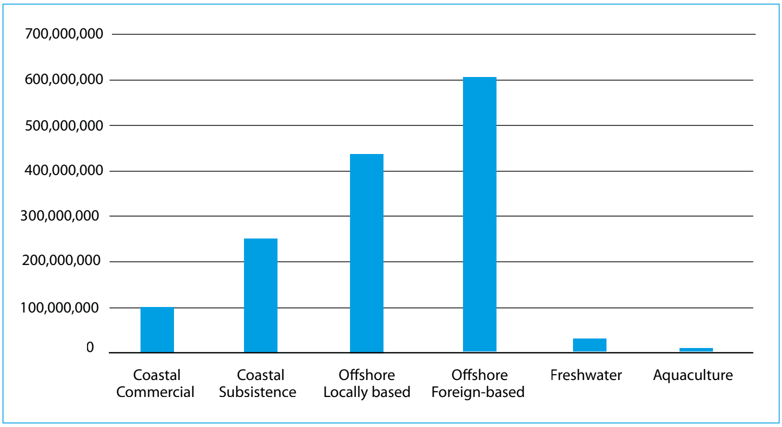


Figure 16-2 : Solomon Islands Fisheries Production by Value (SI$), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and

Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for Solomon Islands from those three studies are provided in Table 16-6.[6]

Table 16-6: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, 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
Coastal Subsistence	1999	13,000	39,000,000
	2007	15,000	84,000,000
	2014	20,000	252,000,000
Offshore Locally based	1999	73,328	335,000,000
	2007	23,619	249,864,889
	2014	41,523	438,879,607
Offshore Foreign-based	1999	948	4,000,000
	2007	98,023	1,174,648,841
	2014	36,573	604,512,524
Freshwater	1999	n/a	n/a
	2007	2,000	11,200,000
	2014	2,300	29,000,000
Aquaculture	1999	n/a	n/a
	2007	8,202 pcs and 165 mt	311,000
	2014	20,000 pcs and 1,530 mt	5,900,000

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the production is measured (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) are likely to reflect real changes in the amounts being harvested.

6 The earliest Benefish Study, Gillett and Lightfoot (2001), did not include aquaculture, freshwater fisheries or the non-independent territories.

16.2 Contribution of Fishing to GDP

Current Official Contribution

The Statistics Division 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: Official Estimate of Fishing Contribution to GDP

	2012	2103	2014
Contribution of formal fishing	169,581	129,997	111,453
Contribution of informal fishing	78,678	82,777	80,784
Total fishing contribution	250,271	214,877	194,251
Total Solomon GDP	6,709,869	7,323,447	7,819,541
Fishing share of GDP	3.7%	2.9%	2.4%

Notes: Current prices (SI$ thousands); figures for 2014 are provisional
Source: Statistics Division (unpublished data)

According to an official of the Central Bank of Solomon Islands (CBSI), 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. (M. Kikiolo, per. com. August 2015)

Method Used to Calculate the Official Fishing Contribution to GDP

In the methodology used by the Statistics Division the fishing sector comprises several components. These are:

- the formal sector; and
- the informal sector, comprising monetary fishing (outboard motor fishing; and other marine products) and subsistence fishing.

According to staff of the Statistics Division (A. Kakate, per. com. August 2015) the contribution of formal sector fishing to GDP is calculated by taking gross output (GO) minus intermediate consumption (IC) to give the value added (VA), which is equivalent to the contribution of the sub-sector to GDP (i.e. GO-IC=VA). For 2014:

- the GO of formal sector fishing was SI$296,036k and IC was SI$184,582k, for a value added of $111,453k;

- the GO of informal sector fishing was SI$236,267k and IC was SI$155,483k, for a value added of SI$80,784k. The value added from monetary fishing was SI$30,225k; and the value added from subsistence fishing was SI$50,559.

The staff of the Statistics Division 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, 2012/2013). For the calculations, SI$13.94 was used as the local market price of fish in 2014.

Alternative Estimate of Fishing Contribution to GDP

Table 16-8, 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 16-8 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 16-8: Fishing Contribution to GDP in 2014 Using an Alternative Approach

Harvest Sector	Value (SI$) (From Table 16-5)	VAR	Value Added
Coastal Commercial	98,032,500	0.75	73,524,375
Coastal Subsistence	252,000,000	0.90	226,800,000
Offshore Locally based	438,879,607	0.52	228,217,395
Freshwater	29,000,000	0.92	26,680,000
Aquaculture	5,900,000	0.70	4,130,000.00
Total	**823,812,107**		**559,351,770**

The total value added in Table 16-8 (SI$559.4 million) is much higher than the official value added of SI$194.2 million (Table 16-7). This results in a fishing contribution to Solomon Islands GDP of 7.2%, which compares with the official contribution of 2.4%. The following considerations are relevant to this difference between the two estimates:

- The gross output for formal fishing in 2014 in the official methodology is given above as SI$296 million, whereas in a previous section of this book the dockside value of the catch of locally based offshore fishing vessels in 2014 (which should be the same) is given as SI$438.9 million.
- The gross output of the informal sector in 2014 in the official methodology is given above as SI$236 million, whereas the combined amount of money paid to coastal commercial fishers and coastal subsistence fishers in 2014 (which should be the same) is SI$350 million.
- From the GDP table, above, it is apparent that the value added ratios for 2014 are 37.6% for formal sector fishing and 34% for informal sector fishing. The VAR for the formal sector appears to be low, and that for informal fishing appears to be very low.

The recalculated percentage fishing contribution to the GDP of Solomon Islands (7.1% for 2014) is slightly higher than the 6.8% recalculated percentage fishing contribution for 2007 given in the Gillett (2009) study.

16.3 Exports of Fishery Production

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 is recorded. Information on annual non-tuna exports from the MFMR database is given in Table 16-9.

Table 16-9: Volume and Value of Fishery Product Exports

PRODUCT		2012	2013	2014
Beche-de-mer[7]	(Kg)		160,397	
	(SI$)		16,215,793	
Trochus Shell	(Kg)	101,600	78,080	103,820
	(SI$)	2,032,000	156,600	1,685,720
Coral	(Kg)	75,920	75,958	72,650
	(SI$)	2,589,865	2,195,373	222,618
Sea weed	(Kg)	921,070	1,343,348	1,112,868
	(SI$)	7,060,700	10,746,784	8,902,946
Other Shell	(Kg)	841 pc	1436 pc	135 pc
	(SI$)	2,264	7,102	551
Blank Button	(Kg)	20,072	40,290	74,124
	(SI$)	3,023,535	2,491,163	4,178,674
Clam Shell (live)	(Kg)		1,108	528
	(SI$)		1,108	528
Crayfish	(Kg)			265
	(SI$)			4,300
Mollusc	(Kg)	250 pc		
	(SI$)	8,698		
Marine shell	(Kg)	1763 pc		
	(SI$)	205,938		
Shark fin	(Kg)	15,087	3,367	27,851
	(SI$)	900,758	428,545	638,808
Abalone	(Kg)			249
	(SI$)			4,986
Reef fish/fillet	(Kg)	68	404	2,829
	(SI$)	954	6,972	28,898
Black lip	(Kg)	250pc	5 pc	12 pc
	(SI$)	8,696	343	627
Aquarium fish	(Kg)	24667 pc	31389 pc	37734 pc
	(SI$)	126,685	158,926	183,780
Invertebrate	(Kg)	15,149	3623 pc	1562 pc
	(SI$)	12,153	12,153	16,262
Coastal Fishery Exports	(Kg)	1,176,737	1,739,405	1,434,627
	(SI$)	15,972,246	32,420,862	15,868,698

Source: MFMR (unpublished data)

7 Unpublished data from SPC show that Solomon Islands averaged 64.7 mt of beche de mer exports per year during the eight-year period 2005–2012, when the beche de mer fishery was nominally closed.

MFMR data indicates that the 2014 tuna exports of Solomon Islands (canned fish, loins and fish meal) were SI$370 million. Combining this figure with the coastal exports in the above table gives total fishery exports of the country in 2014 of SI$386 million.

Data provided by SPC's Statistics for Development Division are quite different. They show SI$418 million of fishery exports in 2014 (this data is presumably from the Customs Department). The SPC data includes frozen whole tuna, while MFMR tuna export data includes only canned fish, loins and fish meal. World Bank data[8] shows total exports of Solomon Islands in 2014 of SI$3,502 million. Therefore, in 2014 the fishery exports of the country represented about 11.9 % of the value of all exports. In Gillett (2009) fishery exports of the country were about 12% of all exports for 2007.

16.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

MFMR staff kindly provided unpublished data on access fees for foreign fishing (Table 16-10). In the table "FFA receipts" are the proceeds from the US Tuna Treaty (not including the project development fund component).

Table 16-10: Access Fees for Foreign Fishing (SI$)

	2012	2013	2014
Fisheries license fees (overseas)	134,608,885	148,800,853	192,542,509
FFA receipts	12,687,657	6,692,326	20,819,435
Total	**147,296,542**	**155,493,179**	**213,361,944**

Source: MFMR (unpublished data)

Staff of MFMR indicated that, in 2014, SI$8.8 million came from longliners, with the balance (SI$204.6 million) coming from purse seiners.

Ministry of Finance (unpublished data) gives similar amounts for access fee receipts. For 2014 the "FFA receipts" are identical, and for "Fisheries license fees (overseas)", SI$193,202,687 is recorded.

The relative contribution of access fees to government revenue is calculated in Table 16-11.

8 http://wits.worldbank.org/countrysnapshot/en/SLB/textview

Table 16-11: Access Fees for Foreign Fishing (SI$)

	2012	2013	2014
Total access fees (from above table)	147,296,542	155,493,179	213,361,944
Total government revenue (Ministry of Finance, unpublished data)	2,515,000,000	2,751,000,000	2,825,000,000
Access fees as a % of government revenue	5.9%	5.7%	7.6%

Source: Table 16-10, Ministry of Finance (unpublished data)

The 2014 budget documents contain the statement: "The Ministry of Fisheries and Marine Resources continues to be the largest domestic source of non-tax revenue."

In Gillett (2009) access fees for foreign fishing represented about 4.4% of total government revenue for 2007.

Other Government Revenue from Fisheries

Unpublished data from MFMR and the Ministry of Finance (identical figures) show the other government revenue from fisheries in 2014 (Table 16-12).

Table 16-12: Other Government Revenue from Fisheries (2014)

Source of Revenue	SI$
Fisheries License Fees (Local)	144,228.32
Export Permit Fees	234,837.95
Fish Processing Licence Fees	479,173.34
Port Entry Fees	47,800.00
Fish and Miscellaneous Sales	635,100.00
Sale of Public Assets	0
Transshipment Levies	1,095,033.87
Observer and Services Fees	550,221.40
Total	**3,186,394.88**

The above table omits the duty obtained from the export of marine products from Solomon Islands. A flat rate of 10% is charged on the declared value of all such exports (Section 1 of Chapter 3 of the 2007 Customs Schedule). Unpublished data from the Ministry of Finance shows that, in 2014, a total of SI$1,661,357 was obtained by the government from taxing fishery exports (under the categories of "fish" and "shells").

16.5 Fisheries-Related Employment

Three types of fisheries-related employment information in Solomon Islands are presented here: data on formal employment, informal employment and gender aspects of fisheries work.

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.

There were two recent national censuses: 1999 and 2009. The report of the 2009 census (NSO 2010) 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)

A report by the Asian Development Bank (ADB 2010) states that reliable, comprehensive employment data for the formal sector is currently unavailable, but it appears that formal sector employment numbers increased from 50,890 in 2002 to 59,161 in 2006. The services sector accounts for 6 in every 10 jobs, the industry sector accounts for 1 in every 10 jobs, and the primary sector accounts for 3 in 10 jobs.

Data from an earlier period (IMF 2005) gives some insight into the relative importance of fishing jobs in the country (Table 16-13).

Table 16-13: Formal Employment in Solomon Islands

	2001	2002	2003	2004
Formal fishing jobs	5,179	5,030	5,015	5,114
Total formal jobs	42,631	41,067	41,723	42,297
Fishing jobs as % of all formal jobs	12.1%	12.2%	12.0%	12.1%

Source: IMF (2005)

The Forum Fisheries Agency tracks tuna-related employment in the region, including for Solomon Islands. Unpublished FFA data shows the jobs relating to the major tuna fishing and processing companies in early 2015 (Table 16-14).

Table 16-14: Tuna Related Jobs in 2015

Type of Job	Number
Local crew	274
Foreign crew	21
Processing / packing	1,470
Other	448
Total	**2,213**

2015 tuna-related employment is compared to earlier periods in Table 16-15. Much of the change in crew jobs relates to the variation in the number of pole-and-line vessels, which are labour intensive.

Table16-15: Locals Employed in the Solomon Islands Tuna Industry

Type of Job	2002	2006	2008
Local Jobs on Vessels	464	66	107
Local Jobs in Shore Facilities	422	330	827
Total	**2,888**	**2,402**	**2,942**

Source: Gillett (2008)

"Local jobs on vessels" refers to vessels that are based in Solomon Islands. Many Solomon Islanders are employed on industrial fishing vessels that are based outside of the country. An earlier study (Gillett and McCoy 1998) showed that 138 crew from Solomon Islands were employed on Korean longliners, Korean purse seiners, Taiwanese longliners, Taiwanese purse seiners, Japanese longliners and US purse seiners. Although the current number of Solomon Island crew on those vessels is unknown, it is likely to have increased significantly, especially on purse seine vessels, due to Honiara emerging as a major tuna transshipment point.

Another aspect of fisheries-related employment in Solomon Islands is jobs in the Ministry of Fisheries and Marine Resources (MFMR). In the 2014 national government budget 76 positions are indicated for MFMR.

A general feature of the information on formal employment related to fisheries in Solomon Islands 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.

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 a report by the Asian Development Bank:

> 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. (ADB 2014)

The 2009 census states that most households in Solomon Islands produce at least some of the food they consume. Eighty-nine percent of all households grew some of their own food, and 60% of households caught fish for their own consumption over the year preceding the census. These proportions were even higher in rural areas, averaging 96% for food and 69% for fishing, but even in urban areas significant proportions of households participated in subsistence food production. For example, in Honiara 42% of households said they had produced food, although only about 8% had caught fish. (NSO 2010)

The following summarises further relevant information on informal fisheries-related employment in Solomon Islands:

- Weeratunge et al. (2011) estimated that nearly half of all women and 90% of men fish.
- The 2005/2006 HIES (Statistics Office, 2006) reports that, of households that are involved in self-employed commercial activity, 16% are engaged in the sale of fish and other seafood.
- An ADB study (Berdach and Llegu 2005) found that, in addition to subsistence harvesting, semi-commercial or artisanal fisheries activities are practised by an estimated 30,000 people, mainly in nearshore areas.
- A 2006 SPC Solomon Islands poverty assessment (Legu 2007) found that 50% of females and 90% of males participated in fishing activities.

Men and women have very different roles in the various activities related to the fisheries sector. Citing numerous references, Weeratunge et al. (2011) provide information on the gender aspects of fisheries-related employment in the country (Box 16-1).

Box 16-1: Gender Aspects of Fisheries-Related Employment in Solomon Islands

Fishing is a predominantly male activity (90 percent of men) with at least one female household member (50 percent of women) engaged in fishing. However, there can be significant variations among provinces and villages. Women are engaged in trading of garden and fish products, including cooked food, as well as weaving, production of shell money, and employment in industrial fish processing plants. In the main fish canning factory in Noro, 80 percent of the 500 workers are women. In many fishing communities men are involved in logging, fish trading, and stone and wood carving as well as other employment such as running small businesses (such as grocery stores, fuel depots, copra mills) and pastors. Home-based tasks, such as household chores, child care, gathering firewood and fetching water are largely women's work while house repair and maintenance, canoe building and repair, and cutting firewood (except firewood collection from mangroves) are predominantly male tasks. In rural Solomon Islands the gender division of labour in fisheries is bounded to some extent by space — men fish in the reefs and offshore, while women and children predominantly fish the nearshore zone on reefs close to villages, lagoons, and mangroves. Men are also engaged in diving and spear fishing; women glean for invertebrates and harvest mangrove fruit and seaweed Mariculture activities conducted by both men and women in some Western Province villages include farming giant clams and corals and both women and men can be engaged in the cultivation of seaweed. In terms of fishing assets, a qualitative assessment in the Western Province showed that men predominate in canoe ownership; however, some women own canoes and others access canoes of kin. Both men and women own their fishing lines and hooks, although men tend to own a larger number of lines. Ownership of fishing spears, engines, nets, boats, sails, and diving gear (masks and fins) is largely confined to men. Some women own swimming goggles and use these for gleaning.

Source: Weeratunge et al. (2011)

SPC (2013) provides some insight into the gender aspects of a "fisher" in Solomon Islands. At the village level across the country, 58% of fishers are men and 42% are women. Analysis of data generated by the "Hapi Fis" project shows that fish vending in Honiara is male-dominated (74%), with a vendor having an average age of 33 years and 9 years of vending experience. (Pomeroy and Yang 2014)

16.6 Levels of Fishery Resource Consumption

Bell et al. (2009) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES 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.

The following summarise other 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 household consumption, country-wide, for 1995, was 32.7 kg.
- The FAO Food Balance sheet for 1999 estimated that household consumption, country-wide, was 32.2 kg.

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. (2009), above.

A survey of two villages in the Western Province, as well as Gizo and Honiara, in March 2010 provides insight into perceived changes in fish consumption. The report of the study (WFQA 2010) states:

> The vast majority of respondents reported that they ate more fish 10 years ago than now. Reasons included depletion of fish resources, population increase, the impact of the tsunami, lack of a fisher in the household, and increase in vegetable intake. The minority who saw no change in fish consumption pointed out that, as in the past, one family member always managed to supply fish for the household. The few who indicated that they ate more fish now than 10 years ago attributed this to changes in technology such as ability to dive in the night, access to fish aggregation devices, health promotion campaigns on the radio, or ease of availability in the market.

The vast majority of fish consumed in Solomon Islands comes from the country's coastal fisheries. Some information is available on fish supplies that originate elsewhere, as follows:

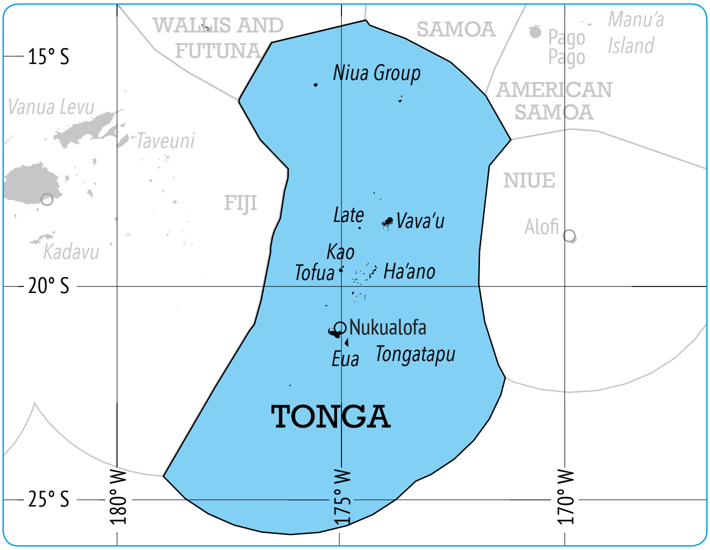
- Based on the 2005/2006 HIES, both in urban and in rural areas, processed fish, particularly Second Grade Taiyo, represents almost 50% of all expenditure on fish. (Weeratunge et al. 2011)
- The salt fish trade in Honiara consists of selling, from tuna transshipment operations, the non-target bycatch and damaged target tuna that are otherwise unmarketable. McCoy (2013) indicates that this trade puts about 440 to 500 mt of fish onto the Honiara market annually. This is approximately equivalent to each of the 70,000 residents of Honiara consuming 6.7 kg of salt fish per year.

16.7 Exchange Rates

The average yearly exchange rates (Solomon Islands dollar (SI$) to the US dollar) used in this report are as follows:

2002	2003	2004	2005	2006	2007	2008
6.75	7.51	7.48	7.53	7.61	7.65	7.67
2009	**2010**	**2011**	**2012**	**2013**	**2014**	
7.88	7.85	7.24	7.07	7.19	7.63	

17 Tonga



17.1 Volumes and Values of Fish Harvests in Tonga

Coastal Commercial Catches in Tonga

The Fisheries Division of the Tongan government does not estimate total coastal fisheries production, but rather only estimates the volumes and values of the throughput of certain fish markets and of exports. Historical attempts to estimate coastal fisheries production in recent years have been as follows:

- Dalzell et al. (1996), in the early 1990s, estimated that subsistence production was 933 mt, worth US$1,901,208, and that the coastal commercial production was 1,429 mt, 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 was T$5,108,000 (Tonga Statistics Department unpublished data). This value added equates to 2,863 mt for non-market fisheries and 3,561 mt for local market fisheries.

- Gillett and Lightfoot (2001) estimated that, in the late 1990s, the coastal fisheries production consisted of subsistence of 2,863 mt, worth T$6,385,000, and coastal commercial of 4,173 mt, worth T$17,362,500.
- Gillett (2009) considered the above studies and examined the results of the 2000/2001 household income and expenditure survey. 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, including: (1) for some years the free-on-board (FOB) value of exports from Tonga's coastal fisheries were much greater than the HIES estimated for all commercial coastal fisheries; and (2) discussions with an HIES specialist at SPC suggested that the Tonga HIES seriously underestimated subsistence fishing (G. Keeble, per.com. September 2008). 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. The 2009 Gillett study subsequently estimated a production in 2007 from Tonga's coastal commercial fisheries of 3,700 mt (of which about 700 mt 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 mt, 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 recently carried out under the MacBio Programme (Salcone et al. 2015). This work is described in Box 17-1.

Box 17-1: Economic Assessment and Valuation of Marine Ecosystem Services

The MacBio project has undertaken national economic assessments of marine and coastal ecosystems in… five Pacific Island countries: Solomon Islands, Kiribati, Fiji, Vanuatu, and Tonga.The principal objective of the economic component of MacBio was to help countries to identify, quantify and, as far as possible, value in monetary units the most relevant marine and coastal ecosystem services in each MacBio country.

[The] report of the assessment describes, quantifies and, where possible, calculates the economic value of Tonga's marine and coastal resources. Seven key marine ecosystem services are evaluated in detail: subsistence and commercial fishing; minerals and aggregate mining; tourism; coastal protection; carbon sequestration; and research, management and education. Others services are explored as well, including cultural and traditional values associated with the sea, potential future industries and other human benefits that have not yet been analysed or exploited.

Source: Salcone et al. (2015)

The MacBio Tonga fishery results can be placed in three categories:

- For *subsistence fisheries*, a household income and expenditure survey was carried out in Tonga in 2009 (Statistics Department 2010), and the Tonga Statistics Department used that HIES data to estimate a value added from subsistence fisheries. The MacBio study used that information, combined with some data from other studies (i.e. cost of fishing), 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 of T$8.27/kg from the 2014 market surveys by the Fisheries Division, that value equates to between 733 mt and 1,320 mt of fishery products.
- For *small-scale coastal commercial fishing*, the MacBio study uses expenditure on seafood (T$9,132,000) and household income from fishing (T$8,339,000), together with seafood prices (T$8.27 and T$5), to estimate commercial production of between 1,008 mt and 1,826 mt.
- 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.

The MacBio study and the present study have different objectives and, accordingly, the way the data are treated and presented sometimes vary. These differences include the following:

- The MacBio study presents the value added of the subsistence and commercial production, whereas the present study presents the imputed farm-gate values (for subsistence) and gross value to fishers (for commercial).
- The focal year for the MacBio study is 2013, while 2014 is the focal year for the present study.
- The present study considers the deep-slope fishery to be a component of the coastal commercial fisheries.

The analysis in the MacBio methodology can be considered quite thorough. The results, however, indicate a much smaller production level than the levels revealed by the other recent studies. This could be because of the MacBio's reliance on the 2009 HIES (or the Statistics Department's analysis of the HIES data), or because it applied the average 2014 Tongatapu retail price of fish to HIES data to obtain the volume of production. As stated above, the Gillett (2009) study rejected the 2001 HIES for estimating fishery production in Tonga. Kelleher (2015) shows that the adjusted expenditure on marketed fish in the 2001 HIES (T$8,820,000) is almost identical to the adjusted expenditure in the 2009 HIES (T$8,836,000), which casts further doubt on using the Tonga HIES data for estimating fishery production. Furthermore, the Tonga Statistics Department does not use the HIES for estimating the value of marketed fish for GDP purposes (see the GDP section below). The Tonga 2009 HIES is not a "fisheries-friendly" HIES – the new HIES being promoted by SPC is far more "fisheries friendly" (i.e. of the type explained in the FSM section of the present report).

As for applying the Tongatapu prices to all fish sales in Tonga, discussions during the present study with fisheries officers and fishers with experience in Vava'u and Ha'apai indicate that prices in those locations are about 60% of the Tongatapu retail prices. Previous studies (e.g. Lautaha and Cohen 2004) suggest that a substantial portion of fish for sale in Tongatapu actually comes from Vava'u and Ha'apai. The distortion caused by high pricing is recognised in the report of the MacBio study:

> The price estimate used to calculate harvest quantity (T$8.27/kg) reflects 2014 prices in Tongatapu markets. This is likely higher than the national average, and is more than three times higher than estimates used by Gillett and Lightfoot in 2001. Dividing gross values by a high price of fish per kilogram will underestimate the total harvest. Using a replacement cost of seafood of T$5/kg would increase harvest estimates to 40%. (Salcone et al. 2015, p. 32).

Given the concerns about using the HIES data to obtain coastal fishery production information, the approach taken in the present study is to enhance the Gillett (2009) 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.

The following further information and developments were considered in the present study:

- According to fisheries stakeholders, inshore fisheries production in Tonga has been relatively stable, with few shocks, with the exceptions of: (a) a cyclone in early 2014 that caused significant damage in Ha'apai; and (b) an increase in fish aggregation devices in about 2011 (S. Mailau, P. Mead, per.com. September 2015).
- The population of Tonga increased 1.1% in the period 2007 to 2014, and there was an increase in the rate of population movement from Vava'u and Ha'apai to Tongatapu (SPC PRISM website information).
- The beche de mer fishery remained closed in 2007. A harvesting boom occurred in 2009, in which exports reached 318 mt, followed by a crash in 2011. In 2014 there was a moderate recovery. with exports of about 140 mt.
- The import of protein alternatives to fish increased. Animal food imports to Tonga were US$15.3 million in 2007, and US$24.9 million in 2014 (www.WITS/worldbank.org).
- Production of the deep-slope fishery was relatively steady, with 14 licensed vessels in 2007, 20 in 2009, and 14 in 2014 (ACP 2013, T.'Ahoafi, per.com. September 2015).
- The number of special management areas (SMAs) increased, from three in 2008 (Gillett 2009) to eight in 2014 (S.Mailau, per.com. September 2015).
- In nominal terms the value of fish exports increased, along with the domestic price of fish (Table 17-1).

Table 17-1: Changes in Fish Exports and the Price of Fish

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Fish exports in current prices (T$ thousands)	5,921	4,159	9,857	9,904	9,605	9,082
CPI fish (2010-11 =100)	78.72	82.19	85.35	97.74	100.00	111.05

Source: Tonga Statistics Departement, as cited in Kelleher (2015)

An examination of the above change factors suggests that, overall, there was no radical change during the period 2007 to 2014 in the production from Tonga's coastal fisheries. The most likely scenario appears to be a moderate increase in the volume and a slightly greater increase in the value of coastal fisheries.

It is estimated that, in 2014, Tonga's coastal commercial fisheries produced 3,900 mt of fish, worth T$33.6 million to fishers. However, the poor factual basis of this estimate should be recognised.

Coastal Subsistence Catches

Following from the above discussion, it is estimated that the production from coastal subsistence fisheries in Tonga in 2014 was about 3,000 mt, worth T$18.7 million to fishers. The poor factual basis of this estimate should be recognised.

Locally Based Offshore Catches

According to the Fisheries Division and industry sources, during 2014 there were a total of 10 Tonga-based longliners. These were all based in Nuku'alofa, and the fleet consisted of four Tongan vessels and six foreign vessels (T. Tavakai, E. Palu, per.com. September 2014). According to the Tonga National Tuna Fisheries Management and Development Plan (Fisheries Division 2015a), by the end of 2014 there were nine vessels: four local vessels and five foreign vessels. The Tonga submission to the August 2015 Scientific Committee of the Western and Central Pacific Fisheries Commission [WCPFC] (Fisheries Division 2015b) states that, in 2014, "100% of the fishing effort of the National longline fleet took place within the Tonga EEZ".

The available information shows the following:

- The total offshore tuna catch in the Tonga zone in 2014 was 679 mt, of which Tongan-flagged vessels caught 243 mt (Forum Fisheries Agency [FFA] 2015)
- The above indicates that the foreign tuna catch in the Tonga zone in 2014 was 1,436 mt.
- The WCPFC submission states that the 243 mt tuna catch was accompanied by 228 mt of non-target and bycatch species.
- Neither the FFA data nor the Tongan WCPFC submission partitions the foreign catch into that made by foreign-based vessels and that made by Tongan-based vessels.

To estimate the catches made by Tongan-based vessels, some assumptions must be made. It is stated above that six foreign vessels were based in Tonga in 2014. The Tongan WCPFC submission states: "In 2014, a total of 19 foreign flagged longline vessels had valid license to fish in the Tonga EEZ." For the purpose of estimating locally based catches, it will be assumed that the locally based foreign vessels caught 32% (6 local vessels divided by 19 total vessels) of the total foreign catch in the Tonga zone. This equates to 460 mt of tuna for locally based foreign vessels.

The total 2014 tuna catch by Tonga-based vessels was therefore 703 mt (i.e. 243 mt Tongan, 460 mt foreign). Assuming the same bycatch proportion for the Tonga-based foreign vessels, the total catch (tuna plus bycatch) for all locally based vessels is estimated to be 1,363 mt.

Using pricing information in FFA (2015) and adjusting for transport to destination markets (i.e. to equate to Tonga in-zone prices) the 2014 locally based offshore tuna catch is estimated to be worth T$4,470,000. Assuming the bycatch was all sold in Tonga at T$5/kg, the bycatch was worth T$3,300,000. The total 2014 offshore catch made by Tonga-based vessels is therefore estimated to be 1,363 mt, which was worth T$7,770,000 to fishers.

Foreign-Based Offshore Catches

Following from the discussion above, on locally based offshore catches, the foreign tuna catch in the Tonga zone in 2014 was 1,436 mt, of which 460 mt were made by Tonga-based vessels. This indicates a tuna catch in the Tonga zone of 976 mt by foreign-based vessels. Assuming the same 2014 bycatch rate as for Tongan-based vessels, the total catch by foreign-based offshore vessels (i.e. tuna plus bycatch) was 1,891 mt.

Using pricing information in FFA (2015), and adjusting for transport to destination markets (i.e. to equate to Tonga in-zone prices), the 2014 foreign-based offshore tuna catch is estimated to be worth T$6,205,000. Assuming the bycatch is worth T$3.50/kg to fishers, it was worth T$3,203,000.

It is estimated that, in 2014, catches by foreign-based offshore vessels in the Tonga zone were 1,891 mt, worth T$9,408,000 to fishers.

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 1994).

Catches of fish in fresh water 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 2014 freshwater fish catch is deemed to be 1 mt, worth T$6,000.

Aquaculture Harvests

Currently, significant aquaculture production in Tonga is limited to giant clams and pearls. There is also farming of milkfish, seaweed, coral and sea cucumber, but on a very small-scale or experimental basis.

The Aquaculture Development Plan (Ministry of Fisheries 2010) states: "Most, if not all, of the giant clam seed stock is produced at the government mariculture facility at Sopu. Approximately 5,000 pieces worth T$17,500 are exported per year". Convention on International Trade in Endangered Species (CITES) export records show that much less than this figure was exported in 2013: 791 individual giant clams. The Head of Aquaculture Research and Development at the Fisheries Division indicated that, in 2014, about 600 giant clams were sold, at a price of T$5 apiece. All of these were sold to aquarium fish dealers for subsequent export. (P. Ngaluafe, per. com. September 2015)

The Aquaculture Development Plan indicates that low-level *Pteria* pearl oyster farming occurs at Vava'u. Oysters are hung using submerged longline techniques. The oysters are either collected from the wild or are harvested from artificial spat collectors. In some cases, a half-pearl "mabe" is inserted on the inside shell valve. The oysters are harvested for their mother-of-pearl shell, and used for handicrafts that are sold. The Head of Aquaculture Research and Development at the Fisheries Division indicated that, in 2014, about 500 pearls (all mabe) were sold at a farm gate price of T$50 per pearl.[1] (P. Ngaluafe, per. com. September 2015)

1 As this price is significantly greater than round pearls produced in Tahiti and the Cook Islands, its validity was the subject of an inquiry to the Head of Aquaculture. That person confirmed the price of T$35.

Based on the above information, it is estimated that the 2014 aquaculture production in Tonga was 1,291 pieces, with a farm gate value of T$28,000.

Summary of Harvests

From the above sections, a crude approximation of the annual volumes and values[2] of the fishery and aquaculture harvests in Tonga in 2014 can be made (Table 17-2).

Table 17-2: Annual Fisheries and Aquaculture Harvest in Tonga, 2014

Harvest Sector	Volume (mt, and pcs where indicated)	Value (T$)
Coastal Commercial	3,900	33,600,000
Coastal Subsistence	3,000	18,700,000
Offshore Locally based	1,363	7,770,000
Offshore Foreign-based	1,891	9,408,000
Freshwater	1	6,000
Aquaculture (pcs)	1,291 pcs	28,000
Total	**1,291 pcs and 10,155 mt**	**69,512,000**

The factual basis for the estimates of coastal commercial and coastal subsistence catches is extremely weak.

2 The values in the table are dockside/farm gate prices.

Figures 17-1 and 17-2 show the volumes and values of the 2014 Tonga fisheries production. Aquaculture is not shown on the volumes figure, due to the use of mixed units (pieces and mt).

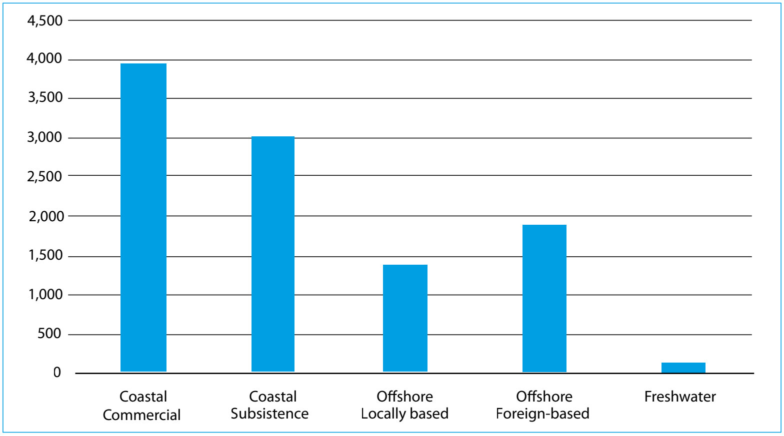


Figure 17-1: Tonga Fisheries Production 2014 by Volume (mt)

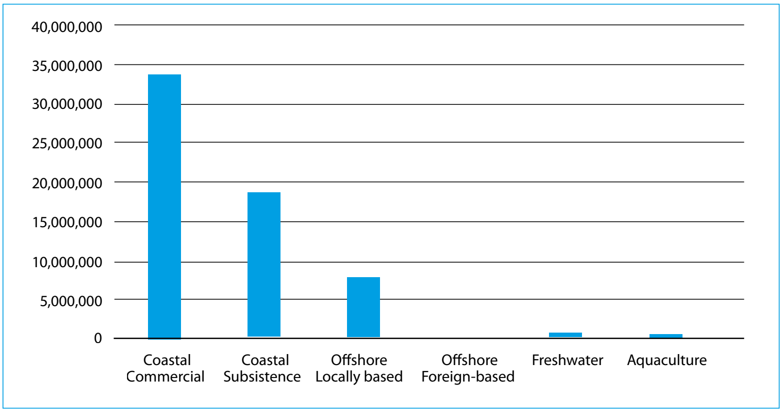


Figure 17-2: Tonga Fisheries Production 2014 by Value (T$)

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The estimated fishery production levels for Tonga from those three studies are presented in Table 17-3.[3]

3 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

Harvests Sector	Estimate Year	Volume (mt, 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
Coastal Subsistence	1999	2,863	6,385,000
	2007	2,800	12,488,000
	2014	3,000	18,700,000
Offshore Locally based	1999	800	5,880,000
	2007	1,119	6,224,625
	2014	1,363	7,770,000
Offshore Foreign-based	1999	45	166,000
	2007	0	0
	2014	1,891	9,408,000
Freshwater	1999	n/a	n/a
	2007	1	4,000
	2014	1	6,000
Aquaculture	1999	n/a	n/a
	2007	12,334	37,000
	2014	1,291 pcs	28,000

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

17.2 Contribution of Fishing to GDP

Current Official Contribution

The National Accounts Statistics (Statistics Department 2015) give the total fishing contribution to GDP. Staff of the Statistics Department kindly disaggregated the total fishing contribution into its three components. The results are given in Table 17-4.

Table 17-4: The Official Fishing Contribution to Tonga GDP

	2011/2012	2012/2013	2013/2014
Fishery sector: Local market component	9.9	8.2	7.8
Fishery sector: Non-market Component	5.9	4.9	4.7
Fishery sector: Export component	5.0	7.4	5.6
Total Fishing	20.8	20.6	18.2
Tonga GDP (market prices)	800.7	779.1	803.7
Fishing as % of Tonga GDP	2.6%	2.6%	2.3%

Notes: GDP at current prices; units: T$ millions
Source: Statistics Department (2015), and M. Masila (per. com. September 2015)

Method Used to Calculate the Official Fishing Contribution to GDP

According to the staff of the 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 2010. The method used for fishing is to sub-divide the sector into three components:

- Local market. This category covers the fish that are caught for sale as food. The Statistics Department indicated that a production approach is used to estimate the value added by the locally marketed sub-sector. The initial data were obtained by surveying "some private businesses". This value is updated by extrapolation, based on population, consumer price index (CPI) 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 imputed from information obtained in a household income and expenditure survey (HIES). In the years following a HIES the estimated GDP contributions have been derived by extrapolation, based on population, CPI and disaster index. As with the locally marketed fish, 20% 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.

The general methodology appears sound, but the quality of the estimate is, to a large extent, dependent on the accuracy of the HIES and of the survey of "some private businesses". In general, the accuracy of the factors used to adjust for the cost of intermediate inputs could be improved with some technical input from the fishing sector. The figures used for market fishing (20%) and export (35%) appear low, while the non-market factor (20%) appears high.

Alternative Estimate of Fishing Contribution to GDP

Table 17-5, 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 17-5 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 17-5: Fishing Contribution to GDP in 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production ($T, from Table 17-2)	VAR	Value Added ($T)
Coastal Commercial	33,600,000	0.60	20,160,000
Coastal Subsistence	18,700,000	0.75	14,025,000
Offshore Locally based	7,770,000	0.20	1,554,000
Freshwater	6,000	0.95	5,700
Aquaculture	28,000	0.50	14,000
Total ($T)	**60,104,000**	--	**35,758,700**

Source: Table 17-2, and consultant's estimate

The total value added from fishing in Table 17-5 (T$35,758,700) for calendar year 2014 is almost double the official estimate of T$18,200,000 for the fiscal year 2013/2014. In the official calculations the non-marketed component is responsible for 26% of the fishing contribution, while in the alternative approach it is responsible for 40%, which is consistent with the idea expressed above, that the 2009 HIES gives low estimates of fishing contribution for non-marketed fish. The value added ratio for marketed fish in the official approach also contributes to the low estimated fishing contribution for non-marketed fish.

17.3 Exports of Fishery Production

The statistics relating to the export of fishery products were extracted from the International Merchandise Trade Statistics (Statistics Department 2015), and are presented in Table 17-6.

Table 17-6: Value of Fishery Product Exports (T$)

	2013	2014
Fish	**4,686,328**	**6,164,098**
of which: Yellowfin tuna (fresh or chilled)	*2,292,329*	*2,652,756*
Bigeye tuna (fresh or chilled)	*37,820*	*172,082*
Other fish fresh or chilled	*1,280,848*	*2,625,803*
Frozen fish	*1,042,114*	*544,061*
All other fish	*33,217*	*169,395*
Crustaceans and molluscs and other aquatic invertebrates; whether in shell or not; fit for human consumption	1,453,391	5,737,565
Coral and similar materials; unworked	322,642	453,930
Seaweeds and other algae	379,362	127,526
Total value of fishery product exports	6,841,723	12,483,119
Total Domestic Exports	21,829,059	28,229,759
Fishery product exports as a % of total domestic exports	31.3%	44.2%

Source: Statistics Department (2015)

Much of the large increase between the years 2013 and 2014 in the table was due to the increased value of the category "Crustaceans and molluscs and other aquatic invertebrates". Unpublished data from the Fisheries Division indicates that the exports of beche de mer (a very high-value product) increased from 56 mt in 2013 to 143 mt in 2014, and this is likely to be responsible for much of the increase.

The report of the MacBio study (Salcone et al. 2015) commented on the changes to fisheries exports in recent years:

> Apart from a sudden increase in 2012 from a change in policy to allow licensing of foreign fishing vessels, exports of fishery products (including aquarium trade) has remained between T$ 4.5 million and T$ 7 million since 2006 (US$ 2.5–4 million). The major exports by value shift substantially among fishery sectors from year to year. In 2010, 66% of fishery export value was from bêche-de-mer, followed by the aquarium trade (18%) and snapper exports (10%); tuna exports were just 3% of total fisheries exports in 2010. In 2011 tuna exports increased to 13%, then to 52% of fisheries exports in 2012. In 2012 shark meat exports increased to 24.5%; and bêche-de-mer fell to just 6.5% (T$ 545,000) of the total value of fisheries exports. In 2013 tuna exports fell to 38% of fisheries exports, but shark meat exports remained high at over T$ 1.4m (26%). The value of shark fin exports averaged about T$ 98,000/yr (1,660 kg) between 2006 and 2013, but shark fin exports have fallen by about 70% since 2006 (4,030 kg).

17.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

Tonga receives payments for two types of foreign fishing in its zone:

- **Purse seine fishing:** Under the terms of the United States (US) multilateral tuna treaty, Tonga and other Pacific Island countries receive payments from the US government and the US tuna industry for fishing access by US purse seine vessels. Some Pacific Island countries consider that all payments under the US treaty are for fishing access, while others treat some components as aid. Actual fishing by the US purse seiners has not occurred in Tonga for many years. According to unpublished data from the US government and the Forum Fisheries ncy, in 2014 Tonga received US$555,815 (T$1,033,816) as a treaty payment.

- **Longline fishing:** The Tongan submission to the Scientific Committee of the Western and Central Pacific Fisheries Commission (Fisheries Division 2015) states: "In 2014, a total of 19 foreign flagged longline vessels had valid license to fish in Tonga EEZ." The "Revenue Report" (unpublished data, Fisheries Division) shows that, in 2014, T$134,000 was paid for foreign fishing vessel licences.

The above indicates that, in 2014, Tonga received T$1,167,816 as access fees for foreign fishing.

The total government revenue in fiscal year 2013/2014 was T$301.5 million (Ministry of Finance and National Planning 2015). The 2014 access fees, of T$1,167,816, therefore equate to about 0.4% of all government revenue for the 2013/2014 fiscal year.

Government Revenue from Fisheries

The "Revenue Report" (unpublished data, Fisheries Division) shows the government revenue generated in 2014 by the Fisheries Division. This is summarised in Table 17-7.

Table 17-7: Other Government Revenue from the Fisheries Sector

Item	Value (T$)
Consumption tax collected on sales by the Fisheries Division	68,229
Fish bond	1,700
Sales of produce	580
Domestic licenses (aquarium, shark fin, seaweed, fish fence, etc.)	235,290
Fees (admin, export taxes, sales of illegal beche de mer, etc.)	198,347
Other sales	44,240
Total	**548,386**

Source: Fisheries Division (unpublished data)

17.5 Fisheries-Related Employment

TSD (2004) gives the results of a 2003 survey of employment in the country. In 2003 there were a total of 34,561 people employed[4] in Tonga, of which 1,050 were employed in the category of "fishing". fisheries-related employment therefore represented 3% of employment in the country during that period. Of those employed in fishing, 180 (17%) were female.

4 Employment in an industry is defined by the study as working at least one hour during the week in the industry.

Tonga Fisheries Project (2005) provided the results of the Tongan Seafood Socio Economic Survey. The survey estimated the number of people engaged in fishing activities: Tongatapu, 6470; Ha'apai, 2053; and Vava'u, 4375. The survey indicated the percentage of self-employed that are fishers: Tongatapu, 5%; Ha'apai, 18%; and Vava'u, 7%. The survey also found that, of the households surveyed, about 64% of Tongatapu households fished for their own supply of seafood and gifts for others. The corresponding figures for Vava'u and Ha'apai were 80% and 82%, respectively.

The Tonga 2009 HIES (Statistics Department 2010) indicates the percentage of "subsistence income" from "fish and seafood", for Vava'u (3.3% of all subsistence income is from fish and seafood), urban Tongatapu (22.7%), rural Tongatapu (14.3%), Ha'apai (4.1%), 'Eua (11.4%), and Ongo Niua (3.3%).

The 2011 census (Statistics Department 2012) provides a considerable amount of information on fisheries-related employment. Table 17-8 shows the main type of work during the week prior to the census for the 64,597 people in Tonga aged 15 years and older. As expected, involvement with fisheries work is most prevalent on small islands and least prevalent in urban areas.

The 2011 census also provides data on involvement with fisheries work by age category. Table 17-8 shows the percentage of people by age who declared their main work type during the previous week as "fishing mainly for sale" or "fishing for own consumption".

Table 17-8: Involvement with Fishing by Geographic Area (15 years +)

	Main type of work during the last week	Fishing mainly for sale	Fishing for own consumption	Fishing as a % of population (15 years +)
Total	64,597	859	437	2,0%
Tongatapu	47,475	552	202	1,6%
Vava'u	9,117	136	87	2,4%
Ha'apai	4,121	141	123	6,4%
'Eua	3,042	20	7	0,9%
Ongo Niua	842	10	18	3,3%
Urban	15,812	108	34	0.9%
Rural	48,785	751	403	2.4%
Greater Nuku'alofa	23,229	259	84	1.5%

Source: Statistics Department (2012)

Table 17-9: Involvement with Fishing by Age Class (15 years +)

All ages	15-19	20-24	25-29	30-34	35-39	40-44	45-49
2,0%	0.8%	1.3%	1.9%	2.6%	2.9%	3.4%	3.4%
50-54	**55-59**	**60-64**	**65-69**	**70-74**	**75+**	**n/s**	
2.8%	2.4%	1.6%	1.4%	0.6%	0.3%	0.0%	

Source: Statistics Department (2012)

A study on the linkages between ecosystems, households, businesses and livelihoods within the Vava'u Archipelago (Salcone 2015, p. 24) contains information on involvement with fisheries:

> Households were asked to describe their fishing activities if they had fished at least once per month during the past year. In total, 45 households (31%) responded that they went fishing at least once per month last year, including reef fishing deep-water fishing or near-shore gleaning. Only 35 households responded that they go reef fishing at least once a month (23%), 29 reported gleaning for invertebrates at least once per month (20%), and only 5 households reported going deep-water fishing at least once per month (3.5%). These numbers were lower than expected given that most households interviewed live within a short walk to the sea. Most households fish primarily for their own consumption or to share with family and community members. Only 13 households (29% of fishing households) reported selling at least some of their catch. Many fishing households donated part of their catch to churches or other households. Households who recorded earning income from reef fishing or gleaning earned on average T$900/month from reef fish (median T$600/mo) and T$430/month from invertebrates (median T$150/mo). Average total income per household from fishing was T$1,192/mo (approx. T$14,000/yr). However, the range in income per month was so great that averages may not be representative of household behavior. The median income per month from all types of fishing was T$600/mo or T$7,200/yr.

The SPC ProcFish programme surveyed four sites in Tonga (Friedman et al. 2009). Table 17-10 is an extract from the report of the survey, showing the importance of both reef fisheries and the sale of fish. The sites were chosen to be representative of sites having active reef fisheries rather than to be representative of all Tongan fishing activity.

Table 17-10: Involvement with Fisheries at the ProcFish Sites

Site	% households involved in reef fisheries	% households with fisheries as most important source of income
Ha'atafu	90.5	28.6
Manuka	84.2	52.6
Koulo	74.1	14.8
Lofanga	85.0	70.0
Average across the 4 sites	82.8	39.1

Source: Statistics Department (2012)

Kronen (2002) provides information on gender in fishing activities from case studies from Ha'apai and Vava'u Islands. It is indicated that there are three substantial differences between women's and men's fishing activities: 1) women tend to prefer daytime fishing; 2) women focus on shallow waters close to shore; and 3) women mainly fish without using canoes or motorised boats.

The Forum Fisheries Agency has a programme– Economic Indicators Project – that collects data on tuna-related employment in standardised form. FFA (2015) contains information on the employment of people from Tonga in the tuna industry (Table 17-11). Forty five Tongans were employed in the tuna industry in 2014. Across the Pacific in 2014 17,663 people were employed as crew on tuna vessels or in tuna processing and ancillary work (FFA 2015). The tuna-related employment in Tonga therefore represents 0.26% of the regional tuna-related employment.

Table 17-11: Tuna-Related Employment in Tonga (number of people employed)

	2009	2010	2011	2012	2013	2014
Processing and ancillary	20	14	17	6	15	12
Local crew	30	17	9	6	7	33
Total	50	31	26	12	22	45

Source: FFA (2015)

17.6 Levels of Fishery Resource Consumption

The 1998 FAO/Australian Agency for International Development (AusAID) Fisheries Sector Review (Gillett et al. 1998) stated:

> It is difficult to make an accurate assessment of the present level of fish intake in Tonga. Although there was a national nutrition survey in 1986, there have been no national food consumption surveys from which average fish consumption could be derived. The figures published for per capita consumption of fish range from a low of 14.0 kg/year to a high of 102.0 kg/year (implying a production of 10,000 mt). Assuming that all the production from inshore fisheries is eaten domestically, and that the best estimate of this in 1995 was 2,362 mt,[5] then this would provide a supply of 24.2 kg/year for the 1996 population of 97,500. Integrating the 575 mt 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:

> A seafood socio-economic survey was carried out in 2004-2005 at Tongatapu, Vava'u and Ha'apai and 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. (2009) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES 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.[6] Fresh fish made up 80% of this amount.

The SPC ProcFish programme carried out survey work at four sites in Tonga (Friedman et al. 2009). That work included estimations of per capita fish consumption. The results (Table 17-12) indicate fish consumption rates at four sites.

5 This is the estimate of Dalzell et al. (1996) for the early 1990s, which Gillett and Lightfoot (2001) considered under-estimated the true numbers.

6 Section 17-1 above, contains some reservations about the accuracy of the Tonga HIES for estimating fisheries production.

Table 17-12: Fishery Product Consumption at ProcFish Site (kg/person/year)

Village	Fresh fish consumption	Invertebrate consumption	Canned fish consumption
Ha'atafu	91.77	20.99	16.99
Manuka	77.64	2.63	9.99
Koulo	46.60	6.68	18.59
Lofanga	65.25	16.83	21.24
Average across the 4 sites	68.57	11.58	16.99

Source: Friedman et al. (2009)

Salcone et al. (2015) examine the FAO Food Balance Sheets spanning the years 2005 to 2011. It is stated that fish consumption results, based on production, imports and exports, vary substantially from year to year. 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.

Kelleher (2015) presents information on canned fish consumption. In the period 2008-2012 approximately 1,400 mt of canned fish was imported annually. The average price was US$1.80 per kg, and the imports were valued at approximately US$2.5 million per year.

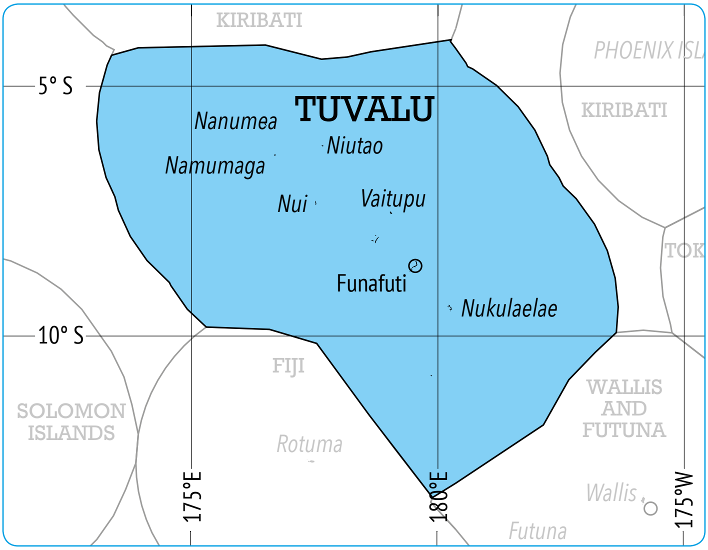
The consumption by Tongans of fish caught by offshore fishing is substantial. It is stated above that the 2014 tuna catch of 243 mt by Tonga-based offshore fishing vessels was accompanied by 228 mt of bycatch. The proportion of fish catch that was not exported (i.e., it was consumed locally) is not known with certainty, but if it assumed (based on general statistics in the fishing industry) 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. This consumption rate does not consider consumption by tourists and other visitors.

17.7 Exchange Rates

The average yearly exchange rates (Tonga Pa'anga (T$) to US dollar) used in this report are as follows.

2006	2007	2008	2009	2010	2011	2012	2013	2014
2.01	2.02	1.85	1.90	1.81	1.73	1.74	1.85	1.86

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), using FAO, SPC and unpublished sources from the late 1980s and early 1990s estimated coastal commercial fisheries production of 120 mt, worth A$97,811 (Australian dollars), and a subsistence catch of 807 mt, 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 mt for population growth over five years, and assumed that 20% of the total catch was commercial. This resulted in an estimate of the coastal commercial catch of 222 mt, worth A$440,000, and a coastal subsistence catch of 880 mt, worth A$1,443,200.
- Gillett (2009) considered the above estimates, and also took into account the result of the 2004/2005 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 mt, worth A$733,666 to fishers, and subsistence production was 989 mt, worth A$2,656,896 to fishers.
- McClurg and Carnie (2012) assumed a total coastal fisheries production of 1,100 mt,[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 assume this 1,100 mt to be reasonably correct, and use it as a working figure.

Since the above estimates were made, some new information has become available that could assist in updating the estimate. In addition, there have been developments and changes that could affect coastal fisheries production. These two categories include the following:

- The price of fish has remained relatively constant since a price spike in 2009. The Funafuti price is currently A$4, for both reef and ocean fish. The outer islands price ranges between A$1 and A$2. (F. Tupau, per. com. November 2015)
- Several studies have pointed to the decreased abundance in recent years of commonly targeted fisheries resources: Siaosi et al. (2012), Basco (2012), Moore et al. (2014).

1 The reference does not mention how this coastal fisheries tonnage was derived, but the authors were furnished with the results of the Gillett (2009) and Gillett and Lightfoot (2001) studies prior to their travel to Tuvalu.

- There has been increased electrification in the outer islands. Currently, all but three islands have electricity 24 hours per day, which allows for the storage of fish and for the utilisation of improved transport to Funafuti. (F. Tupau, per. com. November 2015)
- An alternative view on the electrification of outer islands is that, in some places, it has only recently been installed and people have generally not yet invested in additional refrigeration capacity. Also, the electricity is not being provided for free, and therefore electrification of itself might not significantly change the marginal economics of selling outer islands fish in Funafuti. Improvements in shipping from the outer islands (if any) do not seem to have resulted in more fish for sale in Funafuti. (G. Preston and U. Kaly, per. com. December 2015)
- Ciguatera fish poisoning is becoming an increasingly more serious issue in Tuvalu, especially on Funafuti. According to the 2012 census report (UNFPA 2013) the number of fish affected by ciguatera has increased. New fish species, not affected in the past, are now being reported by fishers as toxic.
- Government support to the community fisheries centres has been withdrawn and the last centre was handed over to the island council in 2014. The centres had a role in facilitating the flow of fishery products to Funafuti.
- The population of Tuvalu has decreased by 0.3% in the period between the Gillett (2009) study and the focal year for the present study, 2014 (SPC's PRISM website data). Because this equates to only 31 less people in the country, the population can be considered stable population over the period.
- The distribution of the population has changed. The 2102 census shows that, during the previous 10-year period, there was considerable movement from the outer islands to Funafuti. In 2002 47% of the population lived in Funafuti, but this had shifted to 57% by 2012 (UNFPA 2012). This shift has implications for the per capita consumption of fish in Tuvalu, as well as for the balance between commercial and subsistence fishing.
- SPC is carrying out a programme in Tuvalu of monitoring pelagic catches made by small-scale ocean fishing. The report of that work, Artisanal fishery analysis – Tuvalu, indicates that over 200 tons of catch was sampled across eight atolls in Tuvalu in 2014. An attempt was made

to raise the catch to the country level using the sampled catch from the logbooks and the effort from the daily activity log. As a minimum, a total of 466 tons of pelagic catch is estimated for all species in 2014. (SPC 2015) This 466 mt cuts across the commercial and subsistence categories of the present study.

- A HIES was carried out by the Tuvalu Central Statistics Division over a period of three-and-a-half months during the first half of 2010, covering eight islands of Tuvalu. The survey collected information from 541 households from these islands. (CSD 2010)

The 2010 HIES deserves additional attention. This HIES was not the new "fisheries-friendly" HIES presently being promoted by SPC (i.e. the type explained in the FSM section of the present report). Nevertheless, some relevant fisheries information can be extracted from that HIES, subject to certain assumptions (some of which may be tenuous). The main assumptions are that: (1) the amount listed for "fish and seafood" expenditures under the headings "in-kind" and "home pr" equate to subsistence expenditures; and (2) the expenditures on commercial and subsistence categories of "Fish and seafood", divided by the Funafuti and outer island prices in 2012, equate to amounts of fishery production; and (3) the 2010 HIES methodology, data collection and analysis were sound. Assuming the validity of these assumptions, fisheries production of Tuvalu in 2012 can be estimated (Table 18-1).

Table 18-1: Coastal Fisheries Production as per the 2010 HIES (mt)

	Funafuti	Outer islands	Tuvalu
Cash	155	114	269
Subsistence	130	1,036	1,166
Total	**285**	**1,150**	**1,435**

Source: CSD (2010)

Some observations can be made on the above data, anecdotes and assumptions, as follows:

- Most of the estimates of Tuvalu fish production appear to be based, directly or indirectly, on the SCP (1997) report that used fish consumption figures from an HIES that was carried out 21 years ago. Accordingly, there seems to be some justification for the use of a more recent HIES.

- On the other hand, a 2004/2005 Tuvalu HIES suggested a coastal catch of 988 mt, which was rejected by the Gillett (2009) study on the basis that it was too low relative to previous studies.

- Taking the above results of the SPC programme that monitored catches made by small-scale ocean fishing (i.e. 466 mt in 2014), and comparing that amount to the overall Tuvalu catches in the table above (1,435 mt), indicates that about one-third of the fisheries production in the country is from ocean fishing, and two-thirds from reef/lagoon fishing – a ratio that many fishery stakeholders in Tuvalu consider reasonable.
- In contrast, the same fishery stakeholders consider that the Funafuti commercial/subsistence ratio in the above table (i.e. 54% commercial, 46% subsistence) is too low.

Considering the above observations and studies, the recent annual Tuvalu coastal fisheries production is estimated to be 1,435 mt, comprised of a commercial component of 300 mt, worth A$912,500 to fishers, and a subsistence component of 1,135 mt, worth A1,366,750 to fishers.

Coastal Subsistence Catches

Following from the above discussion, annual coastal subsistence fisheries production in Tuvalu in recent years is estimated to be 1,135 mt, worth A$ 1,366,750 to fishers.

Locally Based Offshore Catches

In May 2004 two ex-Korean longliners arrived in Tuvalu. In November 2004 those vessels began fishing but soon experienced mechanical problems. During their short fishing operation in Tuvalu the almost negligible catch of the vessels did not come close to covering vessel expenses. (Gillett and Reid, 2005)

There is presently no locally based offshore fishing in Tuvalu. One of the ex-Korean longliners has been anchored in Funafuti lagoon for several years without fishing.

Foreign-Based Offshore Catches

The number of various types of foreign-based offshore vessels that are authorised to fish in the Tuvalu zone is given in Table 18-2.

Table 18-2: Number of Offshore Vessels Licensed in Tuvalu

	Longline	Purse seine	Pole-and-line	Fish carrier	Bunker	Total
2010	135	158	17	6	4	320
2011	96	125	5	0	4	230
2012	108	100	5	18	2	233
2013	33	146	16	7	3	205
2014	43	187	20	29	6	285

Source: Fisheries Department (2015)

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries Commission have been made by the Forum Fisheries Agency, using data sourced from the Oceanic Fisheries Programme of the Pacific Community. The volumes and values can be determined using FFA (2015) (Table 18-3).

Table 18-3: Volumes and Values of the Catches by Offshore Fishing in the Tuvalu Zone

	2010	2011	2012	2013	2014
Purse seine volume (mt)	61,179	55,438	66,472	52,892	96,040
Pole-and-line volume (mt)	-	-	-	-	-
Fresh longline volume adjusted for bycatch (mt)	262	1,913	4,600	2,953	854
Frozen longline volume adjusted for bycatch (mt)	1,013	93	136	211	1,296
Total adjusted volume all gear (mt)	61,441	57,350	71,072	55,845	96,893
Purse seine value adjusted for transport (US$)	67,171,495	83,113,401	122,747,064	95,241,818	122,260,346
Longline value adjusted for bycatch and transport (US$)	6,408,795	10,080,510	26,378,496	10,005,765	9,691,405
Total adjusted value purse seine and longline (US$)	73,580,290	93,193,912	149,125,560	105,247,583	131,951,751

Source: FFA (2015)

From the table above it can be seen that, in 2014, foreign-based offshore fishing in the Tuvalu zone produced 96,898 mt of fish, with an in-zone value of US$132 million (A$161 million).

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 2013) 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 purpose of the present study the production of tilapia in 2014 will be taken as 2 mt, worth A$2,000.

Aquaculture Harvests

Although there have been attempts to culture various fish and invertebrate species in Tuvalu (Uwate et al. 1984), currently the only aquaculture is the farming of milkfish.

Opinions vary markedly about the success of the culture of milkfish in the country:

- Taiwan has a high profile in Tuvalu, and its recent flagship fisheries project has been milkfish farming. However, even the project manager acknowledges that this has been an expensive failure, and it is not yet clear where Taiwan will direct future efforts. Its current priorities seem to lie in the area of aquaculture, which seems to have limited relevance to Tuvalu, either for food security or as a potential source of profitable exports. (McClurg and Carnie 2012)
- Milkfish farming in Vaitupu has potential for growth and development if proper management and utilisation of resources are employed. Notwithstanding the above comments, donor agency, Taiwan ICDF, has done excellent work in the training and development of the milkfish fishpond facility, including the introduction of floating cage culture. (Basco 2012)

Information on the current production of milkfish at the facility on Vaitupu is not readily available. Various staff of the Fisheries Department indicate that between 200 kg and 1,000 kg was sold in 2014. An official of the Ministry of Ministry of Natural Resources stated that the current price is A$2 per kg.

In the absence of detailed production information on milkfish culture, for the purpose of the present study the production of milkfish in 2014 will be taken as 0.5 mt, worth A$1,000.

Summary of Harvests

A crude approximation of the annual volumes and values[2] of the fishery and aquaculture harvest in 2007 can be made from the above sections (Table 18-4).

Table 18-4: Annual Fisheries and Aquaculture Harvest in Tuvalu, 2014

Harvest Sector	Volume (mt)	Value (A$)
Coastal Commercial	300	912,500
Coastal Subsistence	1,135	1,366,750
Offshore Locally based	0	0
Offshore Foreign-based	96,898	160,981,136
Freshwater	2	2,000
Aquaculture	0,5	1,000
Total	**98,336**	**163,263,386**

There was a high dependence on the 2010 HIES in making the estimates of coastal commercial and coastal subsistence catches.

Figures 18-1 and 18-2 show the volumes and values of 2014 Tuvalu fisheries production.

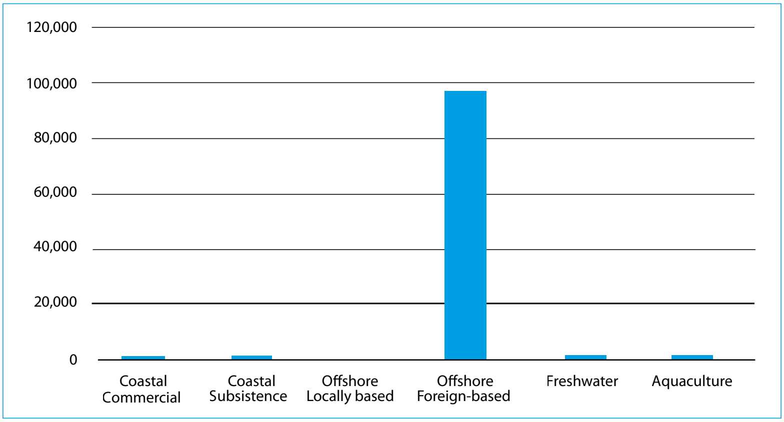


Figure 18-1: Tuvalu Fisheries Production by Volume (mt), 2014

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.

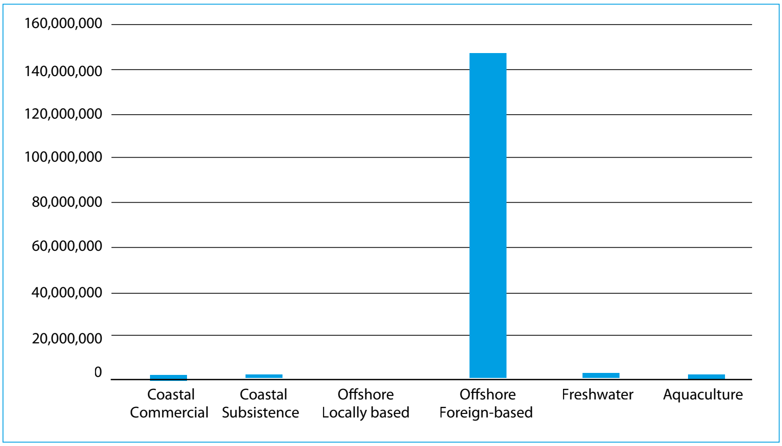


Figure 18-2: Tuvalu Fisheries Production by Value (A$), 2014t

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for Tuvalu from those three studies are provided in Table 18-5.[3]

3 The earliest Benefish Study, Gillett and Lightfoot (2001), did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 18-5: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, and pcs where indicated)	Nominal Value (A$)
Coastal Commercial	1999	220	440,000
	2007	226	733,666
	2014	300	912,500
Coastal Subsistence	1999	880	1,443,200
	2007	989	2,656,896
	2014	1,135	1,366,750
Offshore Locally based	1999	0	0
	2007	0	0
	2014	0	0
Offshore Foreign-based	1999	40,532	58,900,000
	2007	35,541	48,700,000
	2014	96,898	160,981,136
Freshwater	1999	n/a	n/a
	2007	0	0
	2014	2	2,000
Aquaculture	1999	n/a	n/a
	2007	0	0
	2014	0.5	1,000

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the 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) are likely to 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, the most recent estimate of Tuvalu's GDP was carried out in 2013. (G. Alapati, per. com. November 2015)

Nyasulu (2013) states: "At the request of the Government Statistician of the Tuvalu Central Statistics Division, SPC undertook a national accounts mission to Tuvalu from May 7th to 12, 2013. The key objective of the mission was to update National Accounts Statistics for the year 2012." The fisheries-relevant parts of the updated national accounts are given in Table 18-6.

Table 18-6: Fishing Contribution to GDP (A$ thousands)

	2006	2007	2008	2009	2010	2011	2012
Fishing contribution to GDP	2,632	2,697	2,995	2,955	3,728	3,839	3,631
Informal sector component of the above fishing	1,487	1,532	1,538	1,788	1,768	1,776	1,682
Tuvalu GDP	30,414	32,304	36,112	34,749	34,694	38,112	38,512
Fishing as a % of GDP	8.7%	8.3%	8.3%	8.5%	10.7%	10.1%	9.4%

Source: Nyasulu (2013)

Method Used to Calculate the Official Fishing Contribution to GDP

The documentation that accompanies the revised national accounts (Nyasulu 2013) contains the following statement:

> There has been a major revision to the way fishing value added is compiled. The revision has been made throughout the series starting from 2000. Previously market fishing was estimated using HIES data and did not include any other non-household commercial fishing. Within commercial fishing, Community Fishing Centre fishing businesses have been included using provident fund data. Estimates from the Tuvalu Tuna Company have been included based on Provident Fund data. Residency of the Tuvalu Tuna Company was established with its key business as fishing and selling of freshly caught tuna, registered in Tuvalu with appropriate tax identification. Since no taxes are levied on exports, the Tuvalu Customs have no record of the export value of fish caught by the enterprise. Unfortunately, financial statements are only available for 2011.

Alternative Estimate of Fishing Contribution to GDP

Table 18-7, 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 18-4), 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).

Although information on fisheries production is available up until 2014 (Table 18-4) the latest year for which the Tuvalu GDP is available is 2012. As mentioned above, due to the lack of precision in the estimates of production from coastal commercial and coastal subsistence fisheries, those 2014 estimates are likely to be equally applicable for 2012, and accordingly are used in the table below.

It is not intended that the approach in Table 18-7 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 18-7: Fishing Contribution to GDP in 2012 Using an Alternative Approach

Harvest Sector	Gross Value of Production ($A, from Table 18-4)	VAR	Value Added (A$)
Coastal Commercial	912,500	0.70	638,750
Coastal Subsistence	1,366,750	.85	1,161,738
Offshore Locally based	0	---	0
Freshwater	2,000	0.92	1,840
Aquaculture	1,000	0.70	700
Total (A$)	**2,282,250**	**---**	**1,803,028**

The 2014 fishing contribution to GDP from the table above represents about 4.7% of Tuvalu's GDP of A$38.5 million in 2012. As mentioned above, the present study's estimates of coastal fisheries production (and associated values added) are crude approximations, and are likely to be equally applicable to 2012.

The recalculated total value added in 2014 from fishing, in Table 18-7 (A$1.8 million), is half of the official estimate of A$3.6 million for 2012, given above. Without more details on the official methodology it is not possible to identify, with certainty, what is responsible for the large difference. However, it appears that the contribution from "Informal sector component of fishing" of the official methodology is similar to the contribution from "coastal subsistence" in the alternative estimate, so the contribution from formal fishing could be the source of the difference. It could be that the fishing done by "Tuvalu Tuna Company" in the GDP notes above was included in the official GDP estimate. The present study did not include, in the fishing contribution, value added by vessels based outside of Tuvalu. The fact that the note discusses exports by "Tuvalu Tuna Company" may suggest that the company exported fish from Tuvalu, which was not the case, as those fish were not caught in Tuvalu, nor did they come ashore in Tuvalu, and are therefore not considered to be an export of Tuvalu according to IMF rules.

In the Gillett (2009) study the official contribution of fishing to GDP was much less than the recalculated amount with the low value added by "market fishing" in the official estimate (i.e. the opposite situation as was seen in 2014).

Two recent reports (Siaosi et al. 2011; Moore et al. 2014) contain the identical statement: "The small locally based tuna fishery does not contribute to the gross domestic product (GDP) of Tuvalu (Bell et al. 2011)". If this statement refers to the small-scale tuna fishery, it is not correct. The estimated landings of that fleet in 2014 are given, above, as 466 mt, which would equate to a substantial portion of the fishing component of GDP.

18.3 Exports of Fishery Production

The official export statistics of Tuvalu have not been published recently (2010 is the latest published year), and the published statistics are not very detailed (they are only disaggregated to the level of "Consignment", "Other", "Repair" or "Sold"). Staff of the Central Statistics Division and the Customs Department indicate that that virtually the entire "Sold" category consists of marine products or aluminium scraps (crushed cans), with the latter actually being a re-export. In the 2010 official statistics the "sold" export category was valued at A$36,143. (CDS 2012)

Further relevant information on Tuvalu fishery exports is summarised below:

- None of the catch from the large amount of industrial fishing in the Tuvalu zone is brought ashore and exported.
- In the last two decades beche-de-mer is likely to have been the major fishery export of the country. The last shipment of beche-de-mer was about five years ago. (G. Preston, per. com. November 2015)
- There is a substantial quantity of manufacture and export of handicrafts (especially necklaces). (Tiraa-Passfield 1997) The value of shell necklaces per departing flight is estimated to be greater than A$500 (F. Tupau, per. com. November 2015), or about A$52,000 annually.
- The informal export of fish as passenger baggage on departing flights is estimated to be around 50 kg per flight (G. Preston, per. com. November 2015), which, at the prevailing market price for fish, is worth A$20,800 annually.

18.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

Unpublished data kindly provided by the Treasury Department show that money actually received during the year for "Fisheries License" was $13,441,325 for 2013 and $18,028,933 for 2014. The latter is consistent with a statement in Tuvalu's 2015 report to the Scientific Committee of the Western and Central Pacific Fisheries Commission: "Fishery access arrangements provide a critical source of revenue for the Tuvalu Government. Revenues in 2014 were approximately US$18 million, which is more than 55% of the Government's recurrent budget". (Fisheries Department 2015)

In the Tuvalu Government National Budget 2014 (Government of Tuvalu 2013) the "total domestic revenues" are given as A$22,612,966 in 2013 and A$30,950,291 in 2014. The amounts reported by the Treasury Department for "Fisheries License", as a percentage of government revenue, were therefore 59.4% in 2013 and 58.3% in 2014.

Other Government Revenue from Fisheries

Besides the access fees given above, the Government of Tuvalu receives substantial money from its participation in joint venture fishing arrangements and from tuna transshipment. Smaller amounts come from observer levies, chartering boats and filling scuba tanks. Some of the island councils charge for various permits relating to fishing and selling fish. There are no levies on fish exported from the country.

The government receives money from participation in two joint venture entities: Tuvalu Tuna Fong Haur and the Friendly Tuna Fishing Corporation. The former operates a purse seine vessel, and the latter operates two longline vessels. The revenue that the Tuvalu government has received from the two joint ventures is not readily available.

The Tuna Management and Development Plan (Government of Tuvalu 2015) states: "Funafuti is not a major transshipment port for vessels fishing in the western and central Pacific tuna fishery, but transshipment activity increased in 2014. Transshipment provides benefits from fees currently set at US$3 per tonne for cannery grade fish and US$10.00 per tonne for sashimi grade fish. Customs also charges $16 per hour while on board the vessels and port charges also apply." Fisheries Department (2015) reports 43 transshipments in Tuvalu waters in 2014.

18.5 Fisheries-related Employment

The Tuvalu 2012 census (UNFPA 2013) included several questions on whether or not any member of each household engaged in fishing activities. Households that were involved in any fishing activities were then asked further questions about the fishing methods used, the fishing location, and whether the fishing was for subsistence, commercial purposes, or both. The relevant results are summarised below:

- 75.3% of the 1,761 sampled households participated in some kind of fishing. Table 18-8 shows involvement in various types 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 activity. Of these households, 301 were in Funafuti and 135 were in the outer islands.

Table 18-8: Fishing Households Participation in Various Types of Fishing (% of fishing households)

Purpose of fishing	Collecting on reef flat	Collecting on lagoon flat	Collecting on ocean flat	Reef fishing	Lagoon fishing	Ocean fishing
Mainly subsistence	94.1	92.7	88.0	95.0	92.9	82.7
Mainly commercial	2.6	1.8	1.1	0.9	1.3	3.9
Both	3.3	5.6	10.9	4.1	5.8	13.5

Source: UNFPA (2013)

SPC's ProcFish Programme carried out work on several islands in Tuvalu in 2004 and 2005. (Sauni et al. 2008) The report of that survey on Funafuti showed the following:

> Socioeconomic surveys on Funafuti covered eight districts, with a total of 30 households interviewed, covering 245 people. This represented around 5% of the island's households (551) and population (4,500 people). Fisheries were found to provide the first income for 30% of all households and the second source of income for 23% of households. Salaries were the most important income source (50% 1st income, 13% 2nd income). About 43% of all households interviewed reported receiving remittances, with US$1,830 per year the average amount received, which was substantial as it covered about two-thirds of the average annual household expenditure (US$3,080). Fishing on Funafuti was dominated by males (~80%), targeting finfish or a mix of finfish and invertebrate species. Females focused more on invertebrate fishing. Most finfish fishers targeted the lagoon (40%) and sheltered coastal reef (34%). Most invertebrates were caught by gleaning (~70%). Over 60% of the finfish catch was for subsistence needs, with around 30% sold and less than 10% given away. Invertebrates were mainly caught for subsistence and less than 20% of their catch was sold.

Finikaso (2004) elaborates on the gender aspects of participation in fishing activities:

> Fishing activities of women and children are more concentrated in the inshore area employing simple methods, while men's activities are more concentrated on deeper areas and the open ocean, employing more sophisticated methods and gear. Although men also extend their activities to include hose of women and children, women and children normally cannot perform men's tasks. This is simply because deep-sea fishing in Tuvalu tradition is entirely a male activity. To let females carry out fishing while males stay at home is a disgrace to the entire family.

A "time use" study was carried out in 2013 (NAPA 2013). The objective of the work was to gather evidence on how men and women in Tuvalu use their time during the day. Interviews were held in Funafuti, Niutao and Nanumea during April 2013. The fisheries-relevant results (hours spent fishing in a typical day) are given in Table 18-9.The relatively few hours spent fishing in Niutao compared to Nanumea is reflected in the relatively low per capita fish consumption on Niutao (discussed in the next section).

Table 18-9: NAPA Time Use Study Results

Attribute	Group	Hours spent fishing
Gender	Men	1.37
	Women	0.08
Location	Niutao	0.62
	Nanumea	1.21
	Funafuti	0.35
Age	All	0.72
	Youth (under 35)	0.80

Source: NAPA 2013

A Forum Fisheries Agency programme – Economic Indicators Project – collects information on tuna-related employment in standardised form. Table 18-10 shows the Tuvalu's tuna-related employment in recent years. The 365 jobs recorded in Tuvalu in 2014 represent about 2.7% of the 17,663 tuna-related jobs in all Pacific Island countries for that year.

Table 18-10: Tuna Jobs in Tuvalu

	2009	2010	2011	2012	2013	2014
Processing and ancillary	0	0	0	2	2	2
Crew	213	203	205	246	363	363
Total	**213**	**203**	**205**	**248**	**365**	**365**

Source: FFA (2015)

Tuvaluans are also employed as crew on foreign-based industrial tuna vessels. There has not been a census of Pacific Islanders on those vessels since the FFA survey about 18 years ago, but anecdotal information indicates there is a number of Tuvaluans working on Pagopago-based purse seiners and on Rarotonga-based longliners.

18.6 Levels of Fishery Resource Consumption

The following summarise some recent studies on fish consumption in Tuvalu:

- SPC (1997) stated that annual consumption in Funafuti was in the order of 60.0 kg per capita, and on the outer islands was, on average, around 120.0 kg per capita, although there is 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 to 146.0 kg per year.
- 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 are in the range of 100 to 200 kg per year.
- Bell et al. (2009) uses information from HIES conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES 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. Table 18-11 extracts some of the consumption information. Given the assumptions, based on the available data, that (a) invertebrate consumption is 5 kg/capita/year on all islands in Tuvalu, (b) consumption on the three outer islands that were ProcFish study sites can be averaged to obtain consumption for all outer islands, and (c) the split in population (11,099 total) between Funafuti and the outer islands is 57% to 43%, then the ProcFish consumption studies suggest an annual Tuvalu coastal fisheries production of 1,649 mt.

Table 18-11: Fishery Product Consumption from the Tuvalu ProcFish Work

	Funafuti	Nukufetau	Vaitupu	Niutao
Quantity fresh fish consumed (kg/capita/year)	135.0 (±12.2)	185.3 (±9.3)	162.5 (±13.2)	117.8 (±12.0)
Quantity fresh invertebrate consumed (kg/capita/year)	n/a	n/a	n/a	n/a
Quantity canned fish consumed (kg/capita/year)	30.0 (±0.9)	1.5 (±0.5)	2.1 (±0.5)	3.0 (±0.9)
Total fishery product consumption (kg/capita/year)	185.0 plus invertebrates	186.8 plus invertebrates	164.6 plus invertebrates	120.8 plus invertebrates

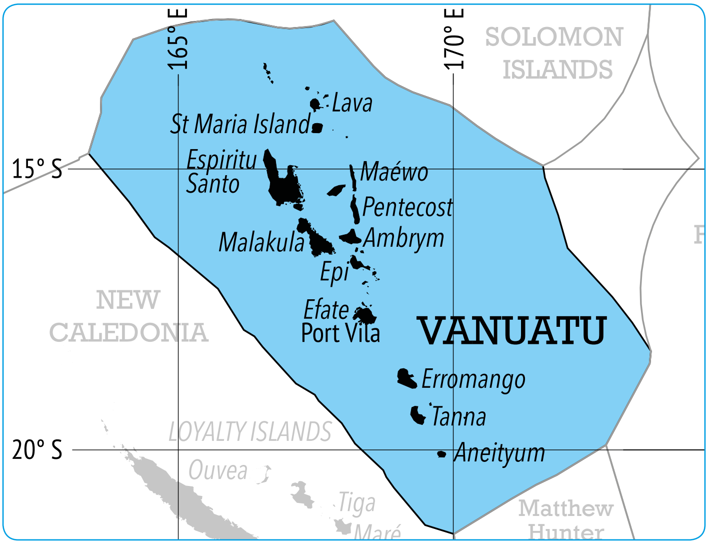
Source: Sauni et al. (2008)

18.7 Exchange Rates

Tuvalu uses the Australian dollar (A$), The average yearly exchange rates (A$ to the US dollar) used in this report are as follows:

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.36	1.31	1.32	1.19	1.10	1.12	0.10	0.98	0.96	1.12	1.22

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), using reference material from the late 1980s and early 1990s, estimated that production from the commercial fisheries was 467 mt, worth US$1,514,364.
- Wright (2000) commented on small-scale commercial fishing. Deep-water snapper fisheries provide 80 tonnes annually to domestic markets, with relatively minor amounts exported. These domestic markets

absorb an additional 40 tonnes 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 tonnes of shell has been 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 mt, worth VT 88 million annually.
- Gillett (2009) considered the above studies, plus some additional information: (a) the results of the 2006 household income and expenditure survey, (b) recent export data, (c) estimates of production from specialised studies, (d) the results of the 2006/2007 agriculture census, and (e) opinions of fisheries specialists. The findings indicated: (1) the household income and expenditure survey (HIES) results show that 336 mt of local fisheries products (worth VT 75.4 million) were purchased in 2006 for domestic consumption; (2) deepwater and pelagic fish catches of 150 mt (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 mt and 152,000 pieces (worth VT 91 million). This equates to a coastal commercial fisheries production of 538 mt, plus 152,000 pieces, worth VT 226.4 million.

In order to make a new estimate of coastal fisheries production, the present study considers the results of a new study that included Vanuatu's coastal fisheries, along with other information on coastal fisheries production in recent years.

An IUCN study that has considerable relevance to valuing the benefits from coastal fisheries in Vanuatu was recently carried out under the MacBio programme. This work is described in Box 19-1.

Box 19-1: Economic Assessment and Valuation of Marine Ecosystem Services

The MacBio project has undertaken national economic assessments of marine and coastal ecosystems in the five Pacific Island countries: Solomon Islands, Kiribati, Fiji, Tonga, and Vanuatu. The principal objective of the economic component of MacBio was to help countries to identify, quantify and, as far as possible, value in monetary units the most relevant marine and coastal ecosystem services in each MacBio country. In Vanuatu the MacBio work focused on determining the economic value of seven marine and coastal ecosystem services in Vanuatu:

- Subsistence fishing, corresponding to the non-commercial fishery where all catch is consumed, given or exchanged but no monetary transaction takes place.
- Commercial fishing, including professional and non-professional inshore fishers well as pelagic fisheries and sport fishing. This fishery corresponds to all capture of pelagic, deep sea, nearshore and inshore reef and mangrove fish and invertebrates sold for food or for shells.
- Mineral and aggregates extraction.
- Tourism, covering all activities linked to coastal ecosystems such as underwater tourism, day tours and recreational boating in Vanuatu.
- Protection against coastal flooding.
- Carbon sequestration. Seagrass and mangrove ecosystems store carbon in living biomass and soil. Based on available habitat data, we quantified and valued the stock of carbon sequestered.
- Research, education and management.

Source: Pascal et al. (2015)

The MacBio study used, as a main source of information, the Vanuatu 2010 HIES. The survey was complemented with information on per capita fish consumption, reports from the Fisheries Department and specialised fisheries work.

The MacBio study and the present study have different objectives and, accordingly, the way the data are treated and presented are sometimes different. Some of these differences are described below:

- The MacBio study values subsistence fisheries production by protein equivalent, whereas the present study uses the farm gate method.
- To account for the value of some non-dietary benefits of subsistence fishing (e.g. social cohesion) the MacBio study applies a factor of 1.3 to the value added.

- The MacBio study presents the value added of the subsistence and commercial production, whereas the present study presents the imputed farm gate values (for subsistence) and value to fishers (for commercial).
- The focal year for the MacBio study is 2013, while the focal year for the present study is 2014.

Table 19-1, below, is based on the MacBio results. The offshore fisheries production and ranges of values were removed from a table of MacBio results so that the presented figures would be more comparable with the present study.

Table 19-1: Coastal Fishery Production in Vanuatu as Estimated by the MacBio Study

		Catch volume (mt)	Annual value-added (US$)
Coastal Subsistence	Rural subsistence	2,600	6,050,000
	Urban subsistence	200	440,000
	Total subsistence	**2,800**	**6,490,000**
Coastal Commercial	Reef fish, deep slope fish, crabs and lobster	1,720	3,300,000
	Trochus and similar	28	100,000
	Bêche-de-mer	40	50,000
	Aquarium trading	0	150,000
	Game fishing	70	1,600,000
	Total commercial	**1,858**	**5,200,000**

Source: Pascal et al. (2015)

The above table exhibits a prominent feature,: the production in the category "reef fish, deep slope fish, crabs and lobster", is very large compared to all of the historical studies cited above (e.g. more than three times as large as that of the Gillett (2009) study), and is also very large relative to the production from subsistence fisheries. Fisheries Department staff consider that the ratio of subsistence to commercial coastal fisheries production in Vanuatu is about 3:1 (P. James, G. Nimoho, per. com. August 2015), and that the ratio in the MacBio study is about 1.5:1.

Based on knowledge of the historical studies cited at the beginning of this section, it can be stated that the MacBio approach is the more methodical in approach to estimating coastal fisheries production than the present study. However, it relies heavily on the results of the 2010 HIES.

Some additional information that may be useful for estimating coastal fisheries production in Vanuatu is provided below:

- Discussion with fishery stakeholders in Port Vila and an outer islands economic survey (Treasury Division 2015) indicate that 2014 prices paid to fishers in Port Vila for finfish ranged from VT 350 to 800 per kg. Prices in Malekula, Tanna, and Ambae ranged from VT 250 to 500 per kg.
- Unpublished data from the Fisheries Department shows, for 2014, production of 50 mt of trochus and 1.7 mt of beche de mer, and an FOB export value of VT 801,772 for aquarium products.
- The annual catch from game-fishing boats catch in recent years has ranged from 48 mt to 64 mt. (McCoy 2013)
- About 60% of the fish consumed on Efate comes from other islands (G. Nimoho, per. com. August 2015).

In view of the information presented above, the volumes of the production of subsistence fishing given by the MacBio study (2,800 mt) are accepted as being accurate. Valuing that production by the farm gate method results in a total value of VT 761.6 million.

The following are estimates for coastal commercial fisheries production: finfish/crustaceans, 1,000 mt (worth VT 450 million to fishers), trochus, 50 mt (VT 12.5 million), beche de mer, 1.7 mt (VT 6 million), aquarium products (VT 65 million), and game fishing, 55 mt (VT 39 million). The total 2014 estimated coastal commercial production in Vanuatu is therefore 1,106 mt, worth VT 572.5 million to fishers.

Coastal Subsistence Catches

The Gillett (2009) study commented on earlier attempts to estimate coastal fisheries production in Vanuatu.

> In a report for FAO, Preston (1996) 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.

As mentioned above, the volumes of the production of subsistence fishing given in the MacBio study (2,800 mt) are accepted as being accurate, and, based on the farm gate method, is valued at VT 761.6 million.

Locally Based Offshore Catches

The paper delivered by the Vanuatu delegation to the 2014 Scientific Committee meeting of the Western and Central Pacific Fisheries Commission (WCPFC) deals mainly with the activities of Vanuatu-flagged vessels, the vast majority of which are not based in Vanuatu. It indicates that 82 longliners and 3 purse seiners were active in the WCPFC area in 2014 (Fisheries Department 2015), but it is not possible to determine from the paper the number that are actually based in Vanuatu. It does state: "The processing plant (Tuna Fishing Vanuatu Limited) in Port Vila harbor ceased operations in February 2014 due to movement of the fleet to the Solomon Islands."

An official of the Fisheries Department stated that, in 2013, three longliners were based in Port Vila, but they departed in early 2014 (W. Obed, per. com. August 2015) – presumably as a result of the closing of the processing plant, mentioned above.

FFA (2015) indicates that catches of tuna by "domestic vessels and locally based foreign vessels" in the Vanuatu zone in 2014 were 437 mt in 2014, worth US$1,834,345 at the destination markets. For that 437 mt to be the tuna catches by Vanuatu-based offshore vessels it must be assumed that all such vessels made all of their catch in the Vanuatu zone. Taking the FFA-estimated tuna catches, and correcting for the volume of the likely bycatch, the value of that bycatch, adjusted for transport of the catch to destination markets, results in a 2014 locally based offshore catch of 568 mt, with an in-zone value of US$1,474,000 (VT 151,100,636).

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 area of the WCPFC for the years 1997–2014 have been made by the Forum Fisheries Agency (FFA 2015), using data sourced from the Oceanic Fisheries Programme of the Pacific Community.

The FFA data shows that the total tuna catch in the Vanuatu zone in 2014 was 8,854 mt, with a destination market value of US$ 34,512,714. It is stated above that the 2014 tuna catches by locally based offshore vessels were 437 mt, with a destination market value of US$1,834,345. The foreign-based tuna catches were therefore 8,417 mt, with a value of US$32,678,369.

Correcting for the volume of the likely bycatch, the value of that bycatch, and transport of the catch to destination markets results in a 2014 foreign-based offshore catch of 10,942 mt, with an in-zone value of US$26,402,601 (VT 2,706,530,705).

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 described below:

- 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 a long historical involvement in Vanuatu fisheries examined the available freshwater fisheries data and discussed the issue of freshwater fishing with other local fisheries specialists, and estimated that recent annual production from freshwater fisheries in the country is about 88 mt per year. (F. Hickey, per. com. August 2015)

The price for subsistence fish, of VT 272/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 800 kg. The recent annual production from freshwater fishing, of 88 mt, is estimated to be worth VT 23,872,000.

Table 19-2: Aquaculture Production in Vanuatu in 2014

Commodity	Type production	Current estimated annual production	Farm gate price	Annual production value (VT)	Comment
Tilapia	Commercial farm	30 mt	550 VT per kg	16,500,000	One commercial farmer; some barramundi produced (VT 1200 per kg); farm destroyed by cyclone Pam in early 2015
Tilapia	Village ponds	1 mt	400 VT per kg	400,000	About 50 village farms; 70% of production is on Santo
Prawns	Commercial farm	13 mt	1,700 VT per kg	22,100,000	One commercial farmer; P. vanamei is produced; most is for domestic market; exports "piggyback" on beef exports
Macro-brachium	Village ponds	120 kg	1,500 VT per kg	180,000	3 village ponds; started production in late 2014
Coral culture	One company	-----	-----	-----	No production since destruction caused by cyclone in 2008
Giant clam	Government operation	300 pieces	300-500 VT per piece	120,000	Most given to communities at about 3 cm in size; lost all standing production in cyclone Pam
Trochus	Government operation	25,000 pieces	----	----	For restocking purposes; lost all standing production in cyclone Pam
Green snail	Government operation	2,000 pieces	----	----	For restocking purposes; lost all standing production in cyclone Pam

Source: S. Rena, G. Norton and R. Jimmy (per. com. August 2015)

Aquaculture Harvests

Using information obtained in discussions with staff of the Fisheries Department, commercial producers and SPC personnel, aquaculture production in Vanuatu in 2014 was estimated, and is presented in Table 19-2.

The above equates to 43 mt and 27,300 pieces, with a farm gate value of VT 39.3 million.

Summary of Harvests

A crude approximation of the annual volumes and values of the fishery and aquaculture harvests in 2014 can be made from the above sections (Table 19-3).

Table 19-3: Annual Fisheries and Aquaculture Harvest in Vanuatu, 2014

Harvest Sector	Volume (mt, and pcs where indicated)	Value (VT)
Coastal Commercial	1,106	572,500,000
Coastal Subsistence	2,800	761,600,000
Offshore Locally based	568	151,100,636
Offshore Foreign-based	10,942	2,706,530,705
Freshwater	80	23,872,000
Aquaculture	27,300 pcs and 43 mt	39,300,000
Total	**27,300 pcs and 15,539 mt**	**4,254,903,341**

The very weak factual basis for the estimate of the coastal and freshwater catches is acknowledged.

Figures 19-1 and 19-2 show the volumes and values of the 2014 Vanuatu fisheries production. Aquaculture is not shown on the volumes figure due to the use of mixed units (pieces and mt).

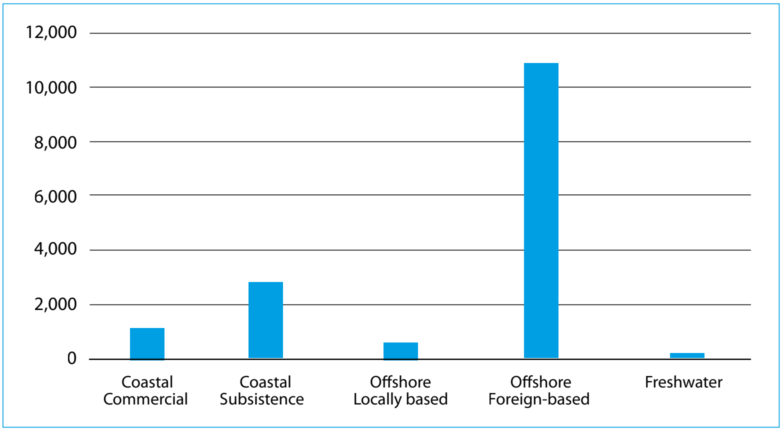


Figure 19-1: Vanuatu Fisheries Production by Volume (mt), 2014

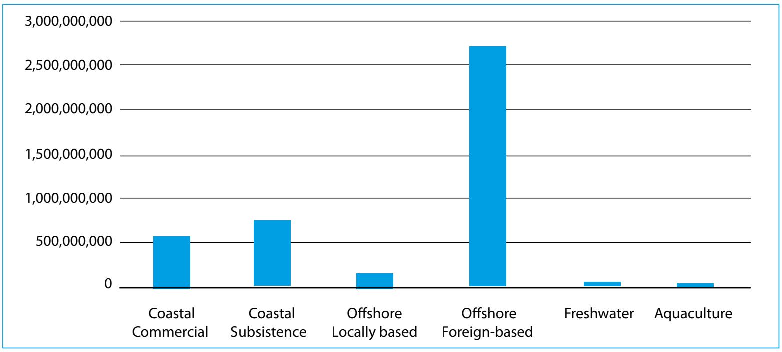


Figure 19-2: Vanuatu Fisheries Production by Value (VT), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for Vanuatu from those three studies are provided in Table 19-4.[1]

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

Table 19-4: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, 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
Coastal Subsistence	1999	2,700	513,000,000
	2007	2,830	597,000,000
	2014	2,800	761,600,000
Offshore Locally based	1999	0	0
	2007	0	0
	2014	568	151,100,636
Offshore Foreign-based	1999	118	32,666,000
	2007	12,858	2,704,380,286
	2014	10,942	2,706,530,705
Freshwater	1999	n/a	n/a
	2007	80	18,000,000
	2014	80	23,872,000
Aquaculture	1999	n/a	n/a
	2007	2,500 pcs and 34 mt	31,600,000
	2014	27,300 pcs and 43 mt	39,300,000

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the production is measured (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 production of the coastal commercial fisheries used the MacBio results. In contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better quality data) are likely to 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 considers commercial fishing as a component of "commercial agriculture", and subsistence fishing as a component of "subsistence custom/traditional agriculture". The nominal and relative contributions of the two categories of fishing are given in Table 19-5.

Table 19-5: Fishing Contribution to GDP (VT millions)

	2011	2013	2014
Contribution of commercial fishing	138	121	109
Contribution of subsistence fishing	344	367	376
Total fishing contribution	482	488	485
GDP of Vanuatu	70,873	72,415	75,803
Fishing share of GDP	0.68%	0.67%	0.64%

Notes: Current prices; 2014 information is provisional
Source: VNSO (2014), VNSO (unpublished data)

Method Used to Calculate the Official Fishing Contribution to GDP

Limited information on the methodology was obtained from the VNSO. According to VNSO staff, export data from the Customs Department and production information from the Fisheries Department are used to estimate the gross output of fishing. VNSO staff acknowledge that the information on fisheries production is old and very limited. The value added ratios used are 0.679 for commercial fishing and 0.90 for subsistence fishing. (B. Tokal, per. com. August 2015)

The following are additional comments on the methods used to calculate the fishing contribution to GDP:

- The Fisheries Department has few data on subsistence fisheries production, so the accuracy of any subsistence production information passed to VNSO is likely to be very low.
- The Gillett (2009) study contained a comment that the value added ratio used in the official calculations for 2007 for subsistence fishing (0.7437) appeared very low. The value added ratios used by VNSO in 2014 for subsistence fishing (0.90) appears to be much more appropriate.

Alternative Estimate of Fishing Contribution to GDP

Table 19-6, 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 19-3), 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 19-6 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 19-6: Fishing Contribution to GDP in 2015 Using an Alternative Approach

Harvest Sector	Gross Value of Production (VT, from Table 19-3)	VAR	Value Added (VT)
Coastal Commercial	572,500,000	0.70	400,750,000
Coastal Subsistence	761,600,000	0.90	685,440,000
Offshore Locally based	151,100,636	0.20	30,220,127
Freshwater	23,872,000	0.90	21,484,800
Aquaculture	39,300,000	0.45	17,685,000
Total (VT)	**1,548,372,636**	--	**1,155,579,927**

The fishing contribution to GDP from Table 19-7 (VT 1,155,579,927) represents about 1.5% of Vanuatu's 2014 GDP of VT 75,803,000,000. This is more than twice the official estimate of 0.63%.

The sub-sectors are examined, below, to determine where the major differences between the official and alternative estimates of fishing contribution occur:

- In the official calculations the value added from subsistence fishing is VT 376 million and the value added ratio is .90, so the gross value of production is VT 417.8 million. This is much less than the gross value of subsistence production of VT 761.6 million, estimated in a section above.
- In the official calculations the value added from commercial fishing is VT 109 million and the value added ratio is .679, so the gross value of

production is VT 160.5 million. This is much less than the gross value of commercial production (coastal commercial and offshore locally based) of VT 723.6 million, estimated in a section above.

- It is concluded that the gross values of production of subsistence and commercial fishing are significantly under-valued in the official estimates.

19.3 Exports of Fishery Production

The Merchandise Trade Statistics (VNSO 2015) give the principal exports of Vanuatu. The fisheries-relevant parts are extracted, and given in Table 19-7.

Table 19-7: Value of Fishery Product Exports (VT millions)

	2012	2013	2014
Shell	27	30	44
Live fish	136	88	142
Fish	185	139	10
Total fisheries exports	348	257	196
Total exports	5,072	3,651	6,100
Fisheries exports as a % of total exports	6.9%	7.0%	3.2%

Source: VNSO (2015)

Other aspects of the fishery exports of Vanuatu are described below:

- Beche de mer is a major export commodity, but does not appear as a separate item in the above table. In 2008 the fishery was closed for a five-year period, 2008–2013. At the completion of that ban, the ban was extended to 2018, although it was opened between 1 September and 31 December to compensate for the large negative economic impacts of tropical cyclone Pam.
- Fisheries Department unpublished data shows no beche de mer exports between 2009 and 2013. There was US$77,731 (VT 7,968,205) of exports in 2014.
- The "shell" category in the table is presumably mostly trochus shell. The export of unprocessed trochus is banned, so the values listed are presumably for trochus button blanks. There have been reports that the single button blanks factory in operation has, in recent years, imported raw trochus from Indonesia, due to insufficient domestic supplies. (F. Hickey, per. com. August 2015)

- The large decline in "fish" exports in 2014 is presumably due to the closure of the tuna processing plant, in February 2014.
- The "live fish" category in the table is presumably aquarium products. The Fisheries Department 2012 Annual Report (Fisheries Department 2013) states: "Aquarium fisheries exports include live fish, live corals, live clams and live rock. Live fish continues to dominate the aquarium export production with 86 percent in 2012 followed by live coral with 11 percent and 3 percent live clams."

19.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

Vanuatu receives payments for two types of foreign fishing in its zone, purse seine fishing and longline fishing as follows:

- Purse seine fishing: Under the terms of the US multilateral tuna treaty, Vanuatu and other Pacific Island countries receive payments from the US government and the US tuna industry that are associated with fishing access by US purse seine vessels. Some Pacific Island countries consider that all payments under the US treaty are for fishing access, while others treat some components as aid.[2] Fishing by the US purse seiners has not occurred in Vanuatu waters since the 2003/04 licensing period, when 217 mt of tuna was caught. (US/NMFS unpublished public domain data) According to unpublished data from the US government and the Forum Fisheries Agency, in 2014 Vanuatu received US$555,815 (VT 56,976,596) by way of treaty payment.
- Longline fishing: Fisheries Department (2015) states that foreign longline fleets from Fiji (3 vessels), China (49), Taiwan (5), and Vanuatu[3] (7) fished in Vanuatu waters, in 2014, for tuna and tuna-like species under bilateral access agreements. According to the Fisheries Department's Principal Surveillance Officer, Vanuatu received VT 280 million for fishing licences. Of this amount, 10% is for domestic licences (i.e. game fishing and deep-slope fishing) and 90% is for fishing access to the Vanuatu zone and authorisations to fish (ATFs). (W. Obed, per. com. August 2015) ATFs are for Vanuatu-flagged fishing vessels to fish outside Vanuatu waters and are not for fishing access to the Vanuatu zone.

2 In the total access fees given below the amounts listed assume all fees are for access.

3 As the Vanuatu vessels are in a table labelled "Annual Catch and Effort Estimates for Each Foreign Fleet", it is assumed that those Vanuatu-flagged vessels are treated as foreign vessels with respect to access to the Vanuatu zone.

Unpublished Fisheries Department data shows that, in 2014, 241 fishing ATFs were issued, generating payments of US$1,255,000 (VT128,650,050). Considering this amount, the VT 280 million above for fishing licences, and the amount for domestic licences (VT 28 million), it is estimated that VT 123,349,950 was paid for access by foreign longline fishing vessels to the Vanuatu zone in 2014.

Total purse seine and longline access fees in 2014 are therefore estimated to have been VT 180,326,546. With total revenue for the Vanuatu government of VT 18.4 billion (IMF 2015), the access fees represent about 1.0% of the Vanuatu government's total revenue.

Other Government Revenue from Fisheries

Government revenue from fisheries other than foreign vessel access fees consist primarily in the ATFs mentioned above (VT128.6 million in 2014) and domestic licences (VT 28 million in 2014). The 2015 Vanuatu government budget (Anon. 2014) lists other estimated income, as follows:

- Product sales – VT 100,000
- Compliance and licensing permit recoveries – VT 3,000,000
- Repair fees – VT 1,500,000
- Seafood verification permit recoveries – VT 2,000,000.

There is at least one type of subsidy in the fisheries sector. McCoy (2014) states that the Fisheries Department operates a fuel tax rebate system in association with the six Provincial Fisheries Centres. Fishers can qualify for a 5% customs duty rebate on fuel (gasoline and diesel) by adhering to certain conditions, including carrying the necessary safety equipment.

19.5 Fisheries-Related Employment

The Vanuatu Socio-Economic Atlas (World Bank 2014) uses information from both the 2009 census and the 2010 household income and expenditure survey (HIES). It shows the following:

- The percentage of households that are involved in any fishing activity: Torba (76.8%), Sanma (48.7%), Penama (36.1%), Malampa (46.1%), Shefa (43.3%), Tafea (43.1%), Port Vila (9.6%) and Luganville (17.6%).

- The percentage of households that report sale of fish/crops/handicrafts as a main source of income: Torba (61.2%), Sanma (67.3%), Penama (67.9%), Malampa (60.0%), Shefa (46.1%), Tafea (60.2%), Port Vila (2.2%) and Luganville (4.4%).
- Areas with especially high involvement in fishing: Northwest Santo, South Maewo, South Malekula, North Erromongo, South Erromongo and Aneityum.

The Vanuatu 2010 HIES found that more than 75% of the adult population practise 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. The HIES estimates for the total income from the sale of fish and seafood was VT 36 million annually – an average of VT 7,100 per household per month. The provinces of Tafea, Shefa (rural) and Torba had the highest proportion of income from the sale of fish and seafood, representing almost two-thirds (64%) of total income from the sale of fish and seafood in Vanuatu. Finfish sales amounted to just over VT 20 million, and all other seafood combined about represented another VT 15 million.

The Malvatumauri National Council of Chiefs carried out pilot study on wellbeing, which measures happiness, and considers variables that reflect Melanesian values (VNSO 2012). The traditional skills that relate to fishing were extracted, and these are given in Table 19-8. The percentages of respondents with particular skills are listed.

Table 19-8: Possession of Skills Related to Fishing (% of respondents)

	Carve canoe	Paddle canoe	Spear fish
Urban	18.6	76.9	42.7
Rural	38.6	75.8	53.8
National	44.4	76.0	51.1

Source: VNSO (2012)

The report of the MacBio study (Pascal et al. 2015) states that tens of thousands of people in Vanuatu depend directly on one or more coastal and marine ecosystem services in Vanuatu. The study identified the following groups that receive significant benefits:

- Participation in the commercial artisanal fishery: more than 5,200 households, representing approximately 10% of the households in Vanuatu.

- Local families for whom fishing on the reef and in the mangroves is a source of regular protein: 15,500 households, representing approximately 30% of households in Vanuatu, which involves more than 74,000 individuals.

SPC's ProcFish programme surveyed four sites in Vanuatu (Friedman et al. 2008). Table 19-9 is an extract from the report of the survey, showing the importance of both reef fisheries and the sale of fish.

Table 19-9: Involvement with Fisheries at the ProcFish Sites

Site	% Households involved in reef fisheries	% Households with fisheries asmost important source of income
Paunangisu	87	28.9
Moso	100	15
Uri-Uripiv	100	38
Maskelyne Archipelago	100	3
Average across the 4 sites	96	21.8

Source: Friedman et al. (2008)

Govan (2015) contains information on employment in Pacific Island government fisheries agencies. It is indicated that the Vanutau Fisheries Department has 54 employed positions.

Data on the gender aspects of fishing in Vanuatu is not plentiful. Readily available information includes the following:

- SPC (2013) uses ProcFish 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 Millenium 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.

The Forum Fisheries Agency has a programme – Economic Indicators Project – that collects data on tuna-related employment in standardised form. FFA (2015) contains information on the employment of people from Vanuatu in the tuna industry (Table 19-10). A total of 92 Ni-Vanuatu were employed in the tuna industry in Vanuatu in 2014. Vanuatu also provides crew for tuna vessels based outside Vanuatu. An officer of the Fisheries Department indicated that about 300 Ni-Vanuatu are employed in this way (W. Obed, per. com. August 2015). Across the Pacific in 2014, a total of 17,663 people were employed as crew on tuna vessels or in tuna processing and ancillary work (FFA 2015). Tuna-related employment in Vanuatu (about 390 people) therefore represents 2.2% of the regional tuna-related employment.

Table 19-10: Tuna-Related Employment in Vanuatu (number of people employed)

	2009	2010	2011	2012	2013	2014
Processing and ancillary	132	37	20	9	46	46
Local crew	132	37	20	9	46	46
Total	**264**	**74**	**40**	**18**	**92**	**92**

Source: FFA (2015)

19.6 Levels of Fishery Resource Consumption

Earlier studies of fishery resource consumption in Vanuatu are described below:

- Preston (1996) 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. (2009) use information from HIES conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES 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.

The MacBio project examined a number of studies on fish consumption in Vanuatu. The report of the study (Pascal et al. 2015) stated that recent studies have found that annual per capita consumption of fresh seafood in Vanuatu varies between 16 and 26 kg.

SPC's ProcFish programme carried out survey work at four sites in Vanuatu. (Friedman et al. 2008) That work included estimations of per capita fish consumption. The results (Table 19-11) show very high consumption of fresh fish at the four sites. However, the sites were not chosen to be representative of Vanuatu, but rather to be representative of sites in the country having active reef fisheries.

Table 19-11: Fishery Product Consumption at ProcFish Sites (kg/person/year)

Village	Fresh fish consumption	Invertebrate consumption	Canned fish consumption
Paunangisu	16.37	n/a	12.10
Moso	18.5	n/a	18.49
Uri-Uripiv	9.9	n/a	4.53
Maskelyne Archipelago	22.16	n/a	1.58
Average across the 4 sites	16.79	n/a	9.04

Source: Friedman et al. (2008)

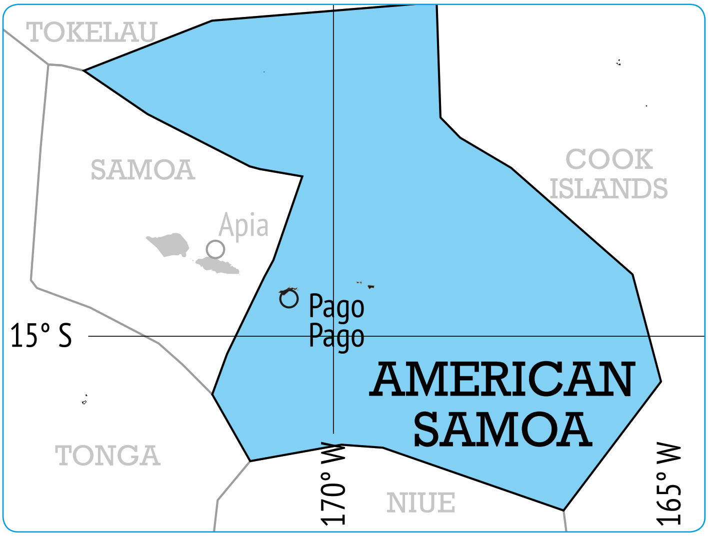
19.7 Exchange Rates

Vanuatu uses the vatu. The average yearly exchange rates (VT to the US dollar) used in this report are as follows:

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
109.00	110.00	104.00	96.77	99.72	95.24	95.43	93.51	96.02	102.51

Fishery Benefits in Pacific Island Territories

20 American Samoa



20.1 Volumes and Values of Fish Harvests in American Samoa

Coastal Commercial Fisheries

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 mt, worth US$178,762.
- Gillett (2009) estimated that the production from the coastal commercial fishery of American Samoa in 2007 (including the pelagic, bottomfish and reef components) was 34.6 mt, worth US$166,000 to fishers.

In American Samoa there are currently a number of US-funded schemes for monitoring fish catches. Box 20-1 summarises the evolution of the schemes and the present situation.

Box 20-1: Monitoring Fish Catches in American Samoa

Prior to 1985, only commercial landings were monitored. From October 1985 to the present, data was collected through a Boat-based creel survey including subsistence and recreational fishing as well as commercial fishing. In September, 1990 a Commercial Purchase (receipt book) System was instituted requiring all businesses in Samoa, except for the canneries, that buy fish commercially to submit to Department of Marine and Wildlife Resources (DMWR) a copy of their purchase receipts. In January 1996, in response to the developing longline fishery a federal longline logbook system was implemented. From 1996 to 1999, the logbooks submitted by the local longliners were edited in Samoa for any missing data and were then sent to the NMFS Honolulu Lab every week for further editing and data processing. Starting with 2000, logbook data was entered and maintained in Samoa and downloaded to NMFS in Hawaii periodically.

- DMWR has currently has the following major data collection programs in place:
- Vessel Classification Program – a vessel history and tracking system for all American Samoa vessels, managed by the Department of Public Safety.
- Boat-based Creel Survey Program (formerly the Offshore Creel Survey System) – access-point creel surveys at boat ramps on Tutuila and in the Manu'a Islands.
- Shore-based Creel Survey Program – roving creel surveys along the shoreline of Tutuila and the Manu'a Islands.
- Commercial Purchase Program – a mandatory purchase receipt system for fish businesses on Tutuila.

Source: DMWR (2013, 2015)

There are some difficulties in using the data generated by these monitoring programmes for the present study. According to the Hawaii-based officer at the US National Marine Fisheries Service with overall responsibility for the monitoring work, not all geographic areas of American Samoa are covered. According to the Director of the Department of Marine and Wildlife Resources, there are challenges with both the gaps in and the 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. For example, the "commercial fisheries" of the American Samoa statistical systems include what is part of "locally based offshore fisheries" in the present study.

In this situation, the approach taken in the present study for estimating coastal fisheries production is to take the commercial fish landings from the surveys, and remove the longline components to obtain the commercial catches taken by the other methods (mainly trolling, bottomfishing, and spearfishing). To this amount must be added the commercial catch (i.e. the catch that is sold) from the coral reef fishery.

- In FY 2013 the catch by the other methods (excluding longline) was 73,479 pounds (33,285 kg) (Department of Commerce 2014).
- Estimating the commercial component of coral reef fishing is difficult due to problems with monitoring and in distinguishing the commercial and subsistence components. Spurgeon et al. (2004) estimated the annual catches of the "artisanal reef fishery" to be 8.4 mt per year, with retail market prices for locally caught fish products of US$5.51 per kg. Fenner et al. (2008) considered six sources of information on the commercial coral reef fishery of Tutuila, concluding that catches were about 10,000 pounds (4,530 kg) in 2004 and 19,000 pounds (8,607 kg) in 2005.

The following further information may assist in estimating coastal fisheries production in American Samoa:

- According to SPC's PRISM website data, the population of American Samoa declined by 11.9% between 2007 and 2014.
- Sabater (2007) reviewed many studies of coral reef fisheries in American Samoa, and concluded that fishing effort in American Samoa has decreased over the past two or three decades, and that reef fish populations are either remaining stable or increasing.
- According to DMWR (2015) the average price paid for pelagic fish in 2014 was US$2.61 per pound (US$5.76 per kg). During the present study it was observed that reef fish were being sold in two markets for an average price of about US$6 per kg.
- American Samoa, suffered considerably from a tsunami in 2009, including damage sustained to its fishing infrastructure. On 29 September 2009 a severe tsunami damaged Leone Village, and low-lying docks, shores and villages within Pago Pago Harbor. The tsunami took a huge toll on the boat-based fishery. (DMWR 2013)

While the above information is inadequate for enabling a firm estimate of the production of the coastal commercial fisheries of American Samoa, a crude estimate of 2014 production would be about 42 mt, worth US$244,000 to fishers.

Coastal Subsistence Catches

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 mt (worth US$814,238) for the early 1990s.
- Spurgeon et al. (2008) reviewed several studies of various components of the subsistence fishery – which together give a subsistence production of 103 mt.
- Zeller et al. (2006) 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 over-exploitation 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 mt in 2002 (Tutuila 39 mt, outer islands 82 mt), appears well substantiated.
- Gillett (2009) relied on the above Zeller estimate, and indicated that the 2007 production was likely to have been 120 mt in 2007, worth US$478,000 to fishers.

Considering the above information, and that presented in the preceding section, it is estimated that the 2014 coastal subsistence production was 120 mt. Using the farm gate approach to valuing subsistence production, it was worth about US$487,000 to fishers.

Locally Based Offshore Catches

For the purpose of the present study, the locally based offshore fleet consists solely of longline vessels. The purse seiners that frequent Pago Pago are not considered to be locally based. This is 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 (USA) implies, through official submissions to the Western and Central Pacific Fisheries Commission, that the purse seiners are not based in American Samoa.[1]

1 In the United States submission to the Scientific Committee of the Western and Central Pacific Fisheries Commission (NMFS 2015) the terminology is "American Samoa-based longline vessels", but for the purse seiners, it is simply "U.S. purse seine vessels".

According to the Director of the Department of Marine and Wildlife Resources, in late 2015 the longliners consisted of one "alia"[2] and 10 larger mono-hulls. In past decades there were many alia longliners, but for various reasons (see Box 20-2) the fleet is almost non-existent at present.

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)

DMWR (2015) states that the American Samoa-based longliners landed 4,755,486 pounds (2,154 mt) of fish in 2014, with a value of US$5,113,395.

Foreign-Based Offshore Catches

All the longline catch in the zone is from locally based vessels and is included in the locally based offshore catches, above. No purse seine catches have been made in the waters of American Samoa in the 1997-2014 period (FFA 2015).

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 purpose of this study it is estimated that the annual catch is 1 mt, worth US$4,000.

2 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 this report is considered to be a component of the "offshore-locally based" catch.

Aquaculture Harvests

The 2007 census of American Samoa Agriculture (USDA 2011) indicates that, in 2007, 15,000 pounds (6.8 mt) of "fish and other aquaculture products" were sold, and 24,500 pounds (11.1 mt) was "used by family". According to the Director of the Department of Marine and Wildlife Resources, aquaculture in American Samoa is currently limited to the production of a small amount of tilapia, but the precise amount is unknown.

For the purpose of the present study the aquaculture production of American Samoa in 2014 is deemed to be 9 mt, with a farm gate value of US$44,500.

Summary of Harvests

From the above sections, a crude approximation of the annual volumes and values[3] of the fishery and aquaculture harvests in 2014 can be made (Table 20-1).

Table 20-1: Annual Fisheries and Aquaculture Harvest in American Samoa, 2014

Harvest Sector	Volume (mt)	Value (US$)
Coastal Commercial	42	244,000
Coastal Subsistence	120	487,000
Offshore Locally based	2,154	5,113,395
Offshore Foreign-based	0	0
Freshwater	1	4,000
Aquaculture	9	44,500
Total	**2,326**	**5,892,895**

3 The values in the table are dockside/farm gate prices.

Figures 20-1 and 20-2 show the volumes and values of the 2014 American Samoa fisheries production.

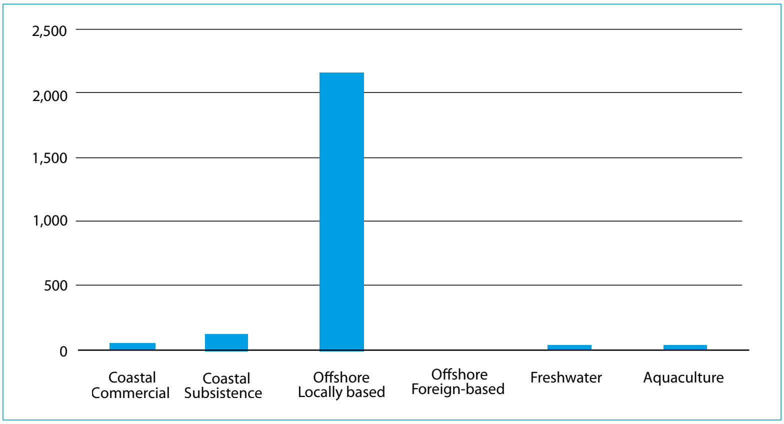


Figure 20-1: Fisheries Production 2014 by Volume (mt)

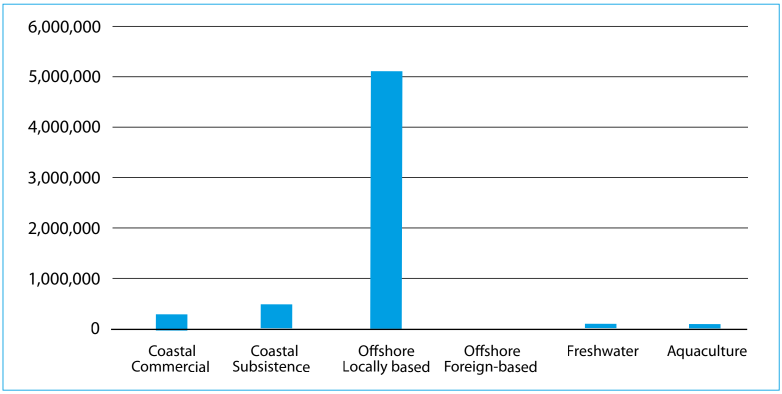


Figure 20-2: Fisheries Production 2014 by Value (US$)

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007 and the present study focuses on 2014. The estimated fishery production levels for American Samoa from those three studies are presented in Table 20-2.[4]

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

Table 20-2: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt)	Nominal Value (US$)
Coastal Commercial	1999	n/a	n/a
	2007	35	166,000
	2014	42	244,000
Coastal Subsistence	1999	n/a	n/a
	2007	120	478,000
	2014	120	487,000
Offshore Locally based	1999	n/a	n/a
	2007	6,632	14,135,083
	2014	2,154	5,113,395
Offshore Foreign-based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Freshwater	1999	n/a	n/a
	2007	1	4,000
	2014	1	4,000
Aquaculture	1999	n/a	n/a
	2007	9	10,000
	2014	9	44,500

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the production is measured (hopefully an 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, 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) are likely to reflect real changes in the amounts being harvested.

20.2 Contribution of Fishing to GDP

Current Official Contribution

The Bureau of Economic Analysis (BEA) of the US Department of Commerce has made estimates of the GDP of American Samoa, under the Statistical Improvement Program funded by the Office of Insular Affairs of the US Department of the Interior.

The BEA estimated that the GDP of American Samoa was US$718 million in 2012 and US$711 million in 2013 (BEA 2014).

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 have a fishing component (M. Timoteo, per. com. September 2015).

Estimate of Fishing Contribution to GDP

Table 20-3 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 20-1), 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 the use of specialised studies (Appendix 3).

Table 20-3: Fishing Contribution to American Samoa GDP in 2014

Harvest Sector	Gross Value of Production (US$, from Table 20-1)	VAR	Value Added (US$)
Coastal Commercial	244,000	0.69	168,360
Coastal Subsistence	487,000	0.85	413,950
Offshore Locally based	5,113,395	0.20	1,022,679
Freshwater	4,000	0.90	3,600
Aquaculture	44,500	0.74	32,930
Total	**5,892,895**	---	**1,641,519**

The contribution of fishing to GDP in 2014 estimated in the table ($1.6 million) represents about 0.2% of the US$711 million GDP estimate for 2013 – the latest year for which an estimate is available.

20.3 Exports of Fishery Production

The fishery exports of American Samoa consist largely of canned tuna and by-products of the canneries. Table 20-4 shows the annual values of the fishery exports, and compares them with the value of all domestic exports.

Table 20-4: Value of Fishery Product Exports (US$)

	2009	2010	2011	2012	2013
Fish meal	3,593,242	3,606,103	3,627,152	2,340,313	n/a
Canned tuna	471,307,000	302,151,000	272,790,000	415,703,000	383,730,000
Pet food	8,622,000	7,496,000	0	0	n/a
All fishery exports	483,522,242	313,253,103	276,417,152	418,043,313	385,664,013
Total domestic exports	491,239,242	315,570,103	278,291,152	418,784,313	386,272,000
Fishery exports as a % of all exports	98.4%	99.3%	99.3%	99.8%	n/a

Source: Department of Commerce (2014)

For 2013 there is no data for fish meal. If the fish meal exports in 2013 are assumed to be US$1.8 million (i.e. the same ratio to canned tuna in 2012), then in 2013 fishery exports were about 99.8% of all exports.

Small amounts of fresh fish are occasionally shipped to Hawaii, but the volumes and values of this trade are insignificant compared to the export of tuna products from the canneries.

20.4 Government Revenue from Fisheries

Access Fees for Foreign 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 about 10 fishing licences per month, at a cost of US$10 per licence – or about US$1,200 per year. 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 (if it exists at all).

20.5 Fisheries-Related Employment

Employment in American Samoa that is directly related to fisheries has two distinct main components: jobs at tuna canneries and involvement in activities related to fishing.

Information on participation in small-scale coastal fisheries is provided in Kilarski et al. (2006) – a survey of 425 people from 34 villages in American Samoa. The results indicated the following:

- Fifty-five percent 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 one to two 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".
- About half of the respondents stated that they fished for recreation, although this was also fairly infrequent, with 71% of these individuals fishing once a week or less.

- Fishermen also fished infrequently for cultural purposes, although cultural, subsistence and recreational fishing categories are difficult to distinguish, as one fishing outing could be motivated by all three reasons.

A prerequisite for understanding fisheries-related employment in the formal sector in American Samoa is knowledge of the Pago Pago tuna canneries. Box 20-3 gives background on the two canneries.

Box 20-3: Tuna Canning in American Samoa

The deepwater harbor at Pago Pago has given American Samoa a natural advantage with respect to landing fish for processing. (Bank of Hawaii, 1997). This harbor, combined with four special provisions of U.S. law, has formed the basis for the success of American Samoa's canneries. The territory is exempt from the Nicholson Act, which prohibits foreign ships from landing their catches in U.S. ports. American Samoan products can enter the United States duty-free if less than 50% of their market value is derived from foreign sources. The parent companies of American Samoa's fish processing plants also enjoy special tax benefits. Additionally, until the new minimum wage act went into effect in July 2007, employers in American Samoa were exempt from Federal Minimum Wage standards, allowing the territory to compete with cheap labor available in other Pacific Islands.

American Samoa is homeport to a distant-water fleet of large commercial vessels that delivers tuna to the canneries in Pago Pago. The captains of the distant-water vessels fish beyond American Samoa's Exclusive Economic Zone in the central and western Pacific Ocean. Annual tuna landings processed by the canneries in American Samoa have run about 160,000 to 220,000 mt in recent years. Skipjack tuna accounted for most of the deliveries, followed by yellowfin and albacore tuna. The current fleet consists primarily of U.S. purse seiners that fish for skipjack and yellowfin tuna, U.S. trollers that fish for albacore tuna, and foreign longliners that fish for albacore, yellowfin, and bigeye tuna. Of the three major companies that dominate the U.S. tuna market, two are engaged in the processing of canned tuna in American Samoa. These are StarKist Samoa (a subsidiary of StarKist Seafood, recently purchased from Del Monte by Korean fishing company Dongwon Enterprise) and Chicken of the Sea (owned by Thai Union Frozen Products of Bangkok). The StarKist Samoa cannery is the largest tuna cannery in the world, producing more than 60% of American Samoa's canned tuna; the rest is produced by Chicken of the Sea. The viability of the tuna industry in American Samoa depends on its continued duty-free status, tax exemption, competitive wage scale, and continued use of the harbor by fishing vessels whose catch comes from outside of American Samoa's EEZ. Without tax exemptions, and with the growth of foreign competitors with lower payroll costs, the future of the canneries could be in jeopardy.

Source: Levine and Allen (2009)

In 2013 (the latest year for which American Samoa employment is available) 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, which represented about 28.9% of people then employed in American Samoa.

Much of the reduced cannery employment in American Samoa is related to rising wages. Levine and Allen (2009) state that the minimum wage for various industries in American Samoa remained stagnant from 2002 until 24 July 2007, with fish canning and processing workers earning a minimum US$3.26 per hour. The Fair Minimum Wage Act of 2007 (Public Law 110-28) ordered wage increases for American Samoan workers. The law stipulated US$0.50 increases to current local minimum wages every year until it reaches the US minimum wage of US$7.25 an hour. An article in the FFA Trade and Industry News (Campling et al. 2015) states that, in October 2015, the US Congress signed a law that increases American Samoa's minimum hourly wage by US$0.40. In tuna processing this has boosted minimum wages from US$4.76/hour to US$5.06/hour.

Information is not readily available on gender aspects of fisheries-related employment in American Samoa. Observations at the canneries indicate that most of the workers on the production lines are women.

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) estimated 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.
- A household income and expenditure survey was carried out in American Samoa in 2005. The HIES determined that annual per capita fish consumption (whole fish equivalent) was 13.6 kg (SPC unpublished data), but this did not include fish taken for subsistence purposes. If the subsistence catch in 2005 was 120 mt and the population was 63,000 (Gillett 2009), this would add 1.9 kg, bringing the total (purchased and subsistence) annual consumption to 15.5 kg per capita.

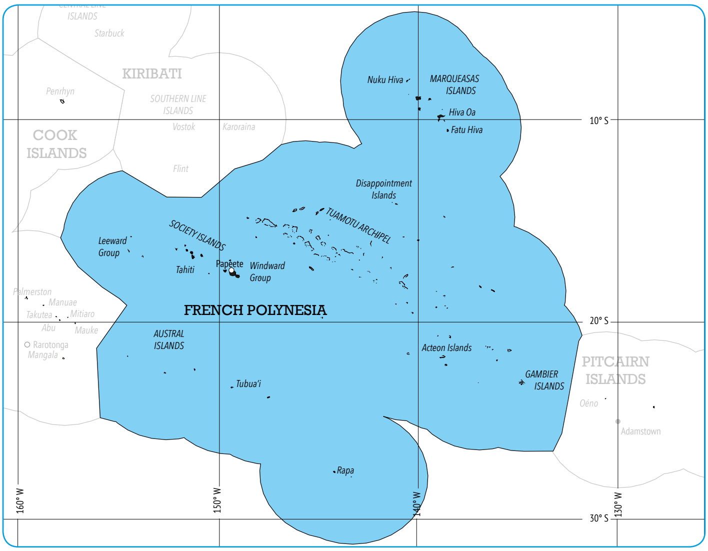
- Craig et al. (2008) examined fish consumption in the outer islands of American Samoa. The per capita catch in 2002 was 71 kg/person, of which 63 kg/person was consumed and the remainder was sent to family members on the main island of Tutuila. The annual subsistence harvest of 37.5 mt consisted of 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 2014 to be 172 mt. This equates to 3.0 kg per person per year. It is difficult to determine the actual annual per capita consumption of fish in American Samoa because the amounts of fish from several 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, (3) imports of fishery products, and (4) the products of the American Samoa canneries that are domestically consumed.

20.7 Exchange Rates

American Samoa uses the US dollar (US$).

21 French Polynesia[1]



21.1 Volumes and Values of Fish Harvests in French Polynesia

Coastal Commercial Catches in French Polynesia

Dalzell et al. (1996) estimated a coastal commercial fisheries production of 2,352 mt (worth US$14,371,469) and a coastal subsistence catch of 3,691 mt (worth US$14,468,720).

As the fishery production in French Polynesia is reasonably well documented in the Statistical Bulletin of the of the government fisheries agency, Direction des Ressources Marines et Minières (DRMM), Gillett (2009) 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 mt (worth XPF [Pacific Franc Exchange]

1 The French version of this chapter appears in Appendix 5, page 595 / *La version française de ce chapitre se trouve page 595 (Appendix 5).*

2 billion to fishers) and the coastal subsistence production was 2,880 mt (worth XPF 1.15 billion to fishers).

The nature of coastal fisheries data available to the present study is similar as was available to the 2009 study Gillett (2009), so, accordingly, a similar approach will be followed here to estimate coastal fisheries production.

DRMM groups the fisheries of French Polynesia into three categories: lagoon, coastal and offshore. The "coastal fisheries"[2] in that categorisation scheme does not correspond to the "coastal fisheries" of the present study – DRMM's use relates to fishing in the open ocean using relatively small vessels. The lagoon and coastal DRMM categories together correspond with the combined coastal commercial and coastal subsistence categories used in the present study.

The DRMM Statistical Bulletin (DRMM 2015) states that, despite the lack of good statistics on lagoon fishery production, it is possible to estimate the 2014 production from lagoon fisheries in the territory as 4,300 mt, which comprises 3,400 mt of lagoon fish, 700 mt of small pelagics, and 200 mt of other products (molluscs, crustaceans, echinoderms, etc.). The total value to fishers is estimated to be XPF 2 billion.

The above came from the 2014 DRMM annual statistics report, but identical statements have appeared in DRMM reports back to at least 2007. The production numbers apparently come from the selective use of several studies covering various geographical areas of French Polynesia.

Staff of DRMM expressed the opinion that lagoon fishery production has not changed significantly over the past decade. They cite various factors that could conceivably have affected production and indicate that the effects are not significant:

- The catch of pelagic fish by longline vessels has a large impact on coastal fisheries production. As longline production increases the demand for reef/lagoon fish decreases.
- It is becoming easier to move fish by air from the Tuamotu Archipelago (where much of the coastal fishing activity occurs) to Tahiti (where most of the coastal fisheries consumption occurs).
- Increases or decreases in pearl production (mostly in the Tuamotu Group) affect the level of coastal fisheries production because there are limited employment alternatives in that area. Pearl farming was at

2 "Pêche côtière" in the DRMM Statistical Bulletin.

maximum production levels in 2000, with the present level being about half of the 2000 level. Increases in coastal fisheries production due to fishing activities of former pearl farmers is tempered somewhat by the fully or over-exploited conditions of some islands.

- Because traditional fish traps ("parc à poissons") are responsible for about half of all coastal fisheries production, a change in the number of traps could have a large effect on production. The number of such traps has increased only slightly in the Tuamotu and Leeward Society Islands. Although a huge swell around 2010 or 2011 destroyed many traps in French Polynesia, the negative effect on production is thought to have been relatively minor, as the larger producers quickly repaired their traps; although marginal producers were affected to a greater extent, as they were not able to repair their traps as quickly.
- A dedicated fish collection vessel operated from 2013 to 2015. The production changes caused by this vessel operating, and then ceasing to operate, are thought to be small, as the vessel did not contribute greatly to production while it was operating.

The various factors above contribute both positively and negatively to fish production. The net result, corroborated by the general consensus of knowledgeable fishery stakeholders, is that coastal fisheries production has remained relatively stable over the last 10 years. Accordingly, the present study assumes that annual production from lagoon fisheries in the territory remains at the often-cited level of 4,300 mt. One change that is recognised by senior DRMM staff is that the proportion of lagoon fishery production that is sold has increased, and is now approximately equal to subsistence catches (A. Stein and C. Ponsonnet, per. com. September 2015). It is therefore estimated that the 4,300 mt catch from lagoon fisheries can be divided into 2,150 mt commercial and 2,150 mt non-commercial.

By using the farm gate system of valuing subsistence production (applying a 30% discount), values and volumes can be assigned to the commercial and non-commercial components of the 2014 lagoon fishery catch. Although the stated value of the lagoon catch in DRMM reports (XPF 2 billion) has remained constant since 2007, it is more realistic to assume at least some value increase during the decade. Accordingly, the 2,150 mt commercial lagoon catch in 2014 is estimated to be worth XPF 1,470,588,235 to fishers, and the 2,150 mt non-commercial lagoon catch is estimated to be worth XPF 1,029,411,764 to fishers.

To obtain the total coastal commercial catch in French Polynesia, the above lagoon catch must be added to the catches of both the "bonitier" and "poti marara" fleets. This category of fishing ("coastal fishery" fleet in the official statistics) requires clarification, because of possible confusion with the "coastal commercial" category of the present study. DRMM (2015) states:

> The coastal fishery comprises two types of boat: the poti marara, (literally "flying-fish boats") which are small boats, 6-8 m in length, made from wood or fibre-reinforced plastic (FRP), and suitable for many different fishing techniques (trolling, vertical longlining or harpooning, operating in the coastal area in the vicinity of 15 nm) and the bonitiers ("skipjack boats"), which are 10-to-12 m long boats made from wood or FRP, targeting skipjack using pole-and-line.

DRMM (2015) indicates that, in 2014 the coastal fleet (45 bonitier and 448 poti marara) caught 3,516 mt of fish, made up of 568 mt from bonitier, and 2,948 mt from poti marara. With an average price to fishers of XPF 721/kg, the value of the coastal fleet production in 2014 was XPF 2,535,036,000.

The volumes and values of the production from coastal commercial fishing in French Polynesia in 2014 are summarised in Table 21-1.

Table 21-1: Coastal Commercial Fishing in French Polynesia in 2014

Category of French Polynesia Fishing	Volume (mt)	Value (XPF)
Lagoon commercial fishing	2,150	1,470,588,235
Bonitier and poti marara fishing	3,516	1,582,000,000
Total	**5,666**	**3,052,588,235**

Coastal Subsistence Catches

As stated in the section above, of the 4,300 mt catch from lagoon fisheries, it is estimated that the non-commercial component is 2,150 mt, worth XPF 1,029,411,764 to fishers.

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 mt. (A. Stein, pers. com. December 2008). For the purpose 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 2014 is estimated to be 2,350 mt, which was worth XPF 1,125,171,000 to fishers.

Locally Based Offshore Catches

DRMM (2015) gives information on the locally based offshore fleet in 2014:

- The fleet consisted of 62 longline vessels, from 65 vessels in 2013.
- 24 vessels were shorter than 16 m in length, 10 were between 16 and 20 m, and 28 were longer than 20 m.
- The total catch in 2014 was 5,390 mt, with albacore, yellowfin and bigeye being 81% of the total.
- 5,168 mt of the total catch was taken by freezer vessels and 222 mt was taken by vessels using ice.

The total catch in 2014 was worth XPF 2.829 billion to fishers (DRMM, unpublished data).

Foreign-Based Offshore Catches

A paper presented by the French Polynesia delegation to the third meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission stated that, in December 2000, all access agreements with foreign fishing fleets had ceased (Ponsonnet et al. 2007).

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 mt per year could be considered an average. (A. Stein, per. com. November 2008).

If this 100 mt 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 47,879,616.

Aquaculture Production

Aquaculture in French Polynesia is dominated by pearl farming. There is also significant culturing of shrimp, finfish and giant clams, and production of much smaller amounts of tilapia, milkfish and rabbitfish.

The production of pearl farms in French Polynesia is not well known. This is due to both under-reporting and non-declaration of exports. According to the DRMM Statistical Bulletin (DRMM 2015), in 2014 the following is known with some degree of certainty:

- There were 6,808 hectares of pearl farms, with 82% by surface area located in the Tuamotu Islands, 16% in the Gambier Islands and 2% in the Leeward Society Islands.
- There were 573 pearl producers in French Polynesia, compared to 534 in 2006.
- 14,578 kg of pearls (8,355,000 individual pearls) were exported during 2014, with an FOB value of XPF 8,704 million.
- Almost all of the above exports were raw cultured pearls (98% by weight; 99% by value).
- 14,341 kg of raw cultured pearls (8,348,000 individual pearls) were exported during 2014, with an FOB value of XPF 8,622 million. The FOB value per gram was XPF 601.
- The remaining pearls were keshi pearls, mabe pearls, and pearls that have been worked (i.e. set in jewellery).
- There has been considerable variability in the value and quantity of raw cultured pearl exports since significant pearl exports from French Polynesia commenced in 1972. The highest value was reached in the year 2000 (XPF 20,073 million), and the maximum quantity occurred in 2010 (16,100 kg).
- The 2014 exports were about 41% of the maximum value reached in 2000, and 89% of the maximum quantity in 2010.

To estimate the French Polynesia 2014 pearl production, and the value to the farmer, certain assumptions are required:

- The declared exports represent about 75% of the pearl production.
- The FOB price can be reduced by 25% to approximate farm gate prices.

The above DRMM pearl production information, in conjunction with the above assumptions, suggests a 2014 French Polynesia pearl production of 14,341 kg of raw cultured pearls (8,348,000 individual pearls), with a farm gate value of XPF 8,622 million.

Information about other types of aquaculture (i.e. non-pearl) in 2014 in French Polynesia was obtained from DRMM aquaculture staff (G. Remoissenet, per. com. September 2015) and from DRMM (2015):

- The production of the shrimp *Litopenaeus stylirostris* was 89 mt, worth XPF 160 million at the farm gate.
- Giant clams for export to the aquarium markets are both harvested from the wild and collected/cultured. Of the 33, 890 giant clams exported in 2014, DRMM staff believe about 13,500 of those clams originated from collection/culture, worth XPF 3,250,000 at the farm gate.
- There was a production of about 12 mt of orbicular batfish (*Platax orbicularis*; "paraha" in Tahitian), worth XPF 24 million.
- Tilapia, milkfish and rabbitfish are also cultured in the territory, but the amounts produced are very small compared to the other commodities above.

Table 21-3 is constructed from the above information. From the table it can be seen that the 2014 aquaculture production of French Polynesia was 101 mt, and 8.4 million pieces, worth XPF 8.8 billion.

Table 21-2: French Polynesia Aquaculture Production in 2014

Commodity	Volume		Farm gate value
	Metric tonnes	Pieces	
Pearls		8,348,000	8,622,000,000
Shrimp	89		160,000,000
Giant clams		13,500	3,250,000
Batfish	12		24,000,000
Total	**101**	**8,361,500**	**8,809,250,000**

Summary of Harvests

An approximation of the annual volumes and values of the fisheries and aquaculture production in French Polynesia in 2014 is given in Table 21-3.

Table 21-3: Annual Fisheries and Aquaculture Harvest in French Polynesia, 2014

Harvest Sector	Volume (mt)	Value (XPF)
Coastal Commercial	5,666	3,052,588,235
Coastal Subsistence	2,350	1,125,171,000
Offshore Locally based	5,390	2,829,000,000
Offshore Foreign-based	0	0
Freshwater	100	47,879,616
Aquaculture	8,361,500 pieces and 101 mt	8,809,250,000
Total	**8,361,500 pieces and 13,607 mt**	**15,863,888,851**

Figures 21-1 and 21-2 show the volumes and values of the 2014 French Polynesia fisheries production. Aquaculture is not shown in the volumes figure, due to the use of mixed units (pieces and mt).

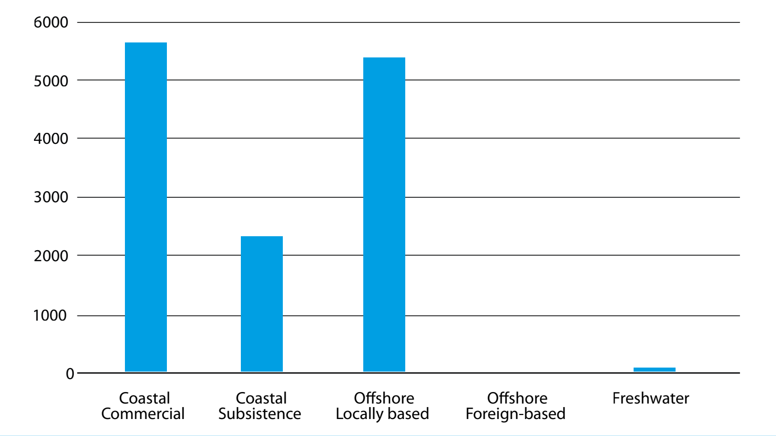


Figure 21-1: French Polynesia Fisheries Production 2014 by Volume (mt)

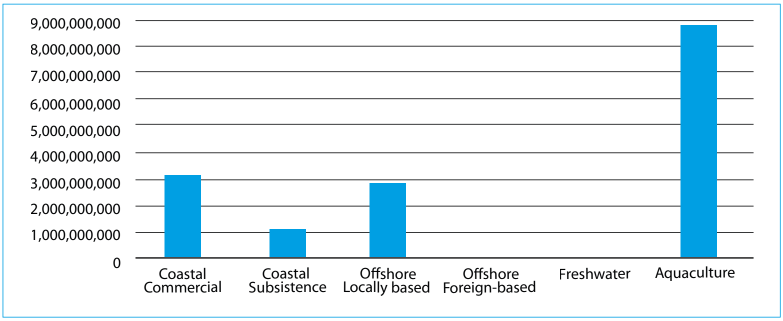


Figure 21-2: French Polynesia Fisheries Production 2014 by Value (XPF)

Past Estimates of Fisheries Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007 and the present study focuses on 2014. The estimated fishery production levels for French Polynesia from those three studies are presented in Table 21-4.[3]

Table 21-4: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, 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
Coastal Subsistence	1999	n/a	n/a
	2007	2,880	1,149,120,000
	2014	2,350	1,125,171,000
Offshore Locally based	1999	n/a	n/a
	2007	6,308	2,457,515,000
	2014	5,390	2,829,000,000
Offshore Foreign-based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Freshwater	1999	n/a	n/a
	2007	100	42,500,000
	2014	100	47,879,616
Aquaculture	1999	n/a	n/a
	2007	56	10,762,600,000
	2014	8,361,500 pcs and 101 mt	8,809,250,000

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the 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. In

3 The earliest Benefish Study, Gillett and Lightfoot (2001), did not include aquaculture, freshwater fisheries or the non-independent territories.

contrast, changes in production figures in the table for the offshore fisheries and aquaculture (based on the availability of better quality data) are likely to reflect real changes in the amounts being harvested.

21.2 Contribution of Fishing to GDP

Current Official Contribution

According to staff of the Institut de la Statistique de la Polynesie Francaise (ISPF), the last year for which detailed estimates of GDP were made was 2011. In subsequent years a rapid assessment of the GDP was prepared, but this rapid assessment does not contain any new information for the fishing sector. (A. Ailloud, per. com. September 2014). According to ISPF (2015) the GDP of French Polynesia in 2014 was estimated, by rapid assessment, to be XPF 538.6 billion.

Using ISPF (2015) and ISPF unpublished data, the contributions of fishing, pearl culture and other forms of aquaculture to GDP can be calculated (Table 21-5).

Table 21-5: Fish and Aquaculture Contribution to GDP (current prices, XPF millions)

	2008	2009	2010	2011
Pearl culture	3,258	3,653	3,060	2,965
Fishing and other forms of aquaculture	3,721	4,070	4,534	5,173
Total fishing and aquaculture	6,979	7,723	7,594	8,138
French Polynesia GDP	579,049	563,347	547,877	531,861
Aquaculture and fishing as a % of GDP	1.2%	1.4%	1.4%	1.5%

Source: ISPF (2015) and ISPF (unpublished data)

Method Used to Calculate the Official Fishing Contribution to GDP

According to staff of the Institut de la Statistique de la Polynesie Francaise (A. Ailloud, per. com. September 2014), important aspects of the method of calculating the contribution of fishing and aquaculture to GDP are as follows:

- 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 shrimp aquaculture. For

pearl culture the FOB export value of pearls and pearl products are multiplied by a value added ratio of 0.336 to obtain the value added (i.e. contribution to GDP).

- The amount of production from non-commercial fishing (5,740,000 kg in 2011) was determined through a 1987survey. The amount of production from commercial production (1,455,613 kg in 2011) is the sum total of estimates of commercial lagoon fishing, ocean fishing and shrimp aquaculture.
- The price paid to fishers is the retail fish of price divided by 1.35 (denominator adopted by the ISPF).
- The total price paid to fishers is multiplied by a value added ratio to obtain the total value added.
- 0.3361 is the value added ratio for the entire commercial agriculture sector (includes fishing and pearl culture). This ratio was determined by examining the records of 154 companies in the agricultural sector for the year 2005. The value added for subsistence fishing is taken to be 1 (i.e. assuming no intermediate consumption).

The following comments can be made about the ISPF method of calculating the contribution of fishing and aquaculture to GDP:

- For pearl culture, using the FOB price (rather than the farm gate price) results in an over-estimation of the contribution. However, this may compensate, to some degree, for the pearl exports that are not declared.
- The ISPF commercial fisheries production estimate looks very small relative to non-commercial production: 1,455,613 kg versus 5,740,000 kg. According to DRMM staff the respective production levels have become considerably more equal over the past 25 years, to the point that production by commercial lagoon fishing is approximately equal to non-commercial lagoon fishing. To get total commercial fishing production, the catches of the ocean fishing (poti marara, bonitier and longliner) must be added to the lagoon commercial production. According to information in DRMM (2015) the volume of all commercial fisheries production is about five times that of non-commercial production.
- Using a single value added ratio for all types of commercial fishing, aquaculture and agriculture appears inappropriate. Refining VARs to specific sub-sectors could provide much better estimates of value added.

Alternative Estimate of Fishing Contribution to GDP

Table 21-6, 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 21-3), 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 using by specialised studies (Appendix 3). The VAR for pearl culture was determined by examining actual company accounts of pearl culture operations in Cook Islands and Fiji.

Table 21-6, below, is for 2014, whereas the latest results of the official method of estimating fishing contribution to GDP in French Polynesia are for 2011.

It is not intended that the approach in Table 21-6 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 21-6: Fishing Contribution to GDP in 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production (XPF, from Table 23-3)	VAR	Value Added (XPF)
Coastal Commercial	3,052,588,235	0.55	1,678,923,529
Coastal Subsistence	1,125,171,000	0.70	787,619,700
Offshore Locally based	2,829,000,000	0.20	565,800,000
Freshwater	47,879,616	0.85	40,697,674
Aquaculture	8,809,250,000	0.45	3,964,162,500
Total (XPF)			**7,037,203,403**

From the table, a total contribution from fishing/aquaculture of XPF 7,037 million is estimated for 2014. In the section above on the official contribution, an official contribution of XPF 8,138 million was estimated for 2011. Bearing in mind that these two estimates are for different years, most of the differences between the estimates originate from the production of coastal/offshore fishing and the VARs applied. Reasonably good estimates of fisheries production are available at DRMM in Papeete.

Although 2011 is the latest year for which detailed estimates of GDP have been made, a "rapid accounting" was carried out for 2014, resulting in a

French Polynesia GDP estimate of XPF 538.6 billion (CEROM 2015).[4] The alternative estimate of the 2014 fishing contribution to GDP from the table above (XPF 7.037 billion) represents 1.3% of the 2014 GDP.

21.3 Exports of Fishery Production

A publication of the Institut de la Statistique de la Polynesie Francaise (ISPF 2015) provides levels of exports of French Polynesia (presumably, but not confirmed, from customs data). Table 21-7 extracts fisheries-relevant information.

Table 21- 7: Value of Fishery and Aquaculture Product Exports (XPF millions)

	2013	2014
Pearl products	7,881	8,819
Fish	1,093	1,241
Pearl shells	249	199
Total fisheries and aquaculture exports	9,223	10,259
Total all exports from French Polynesia	11,910	12,824
Fisheries and aquaculture exports as % of all exports	77.4%	80.0%

Source: ISPF (2015)

A more detailed accounting of exports is given in DRMM (2015). Table 21-8 takes that information and ranks the exports in terms of ascending value.

Table 21-8: Relative Importance of the Fisheries and Aquaculture Exports in 2014

	Volume		FOB Value (XPF millions)	% FOB value of all fisheries & aquaculture exports
	Pieces	Metric tonnes		
Aquarium fish	27,900		23.8	0.2%
Beche de mer		3.9	25.9	0.3%
Giant clams	33,890		46.8	0.5%
Coral and shells (pearl shell, trochus, green snail)		2,232	283	2.8%
Pelagic fish		1,445	1,140	11.2%
Pearls and pearl products	8,355		8,704	85.1%
Total	**70,145**	**3,681**	**10,223.5**	**100.0%**

Source : DRMM (2015)

4 This "rapid accounting" did not include detail about new fishing information.

21.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

In December 2000 all access agreements with foreign fishing fleets ceased (Ponsonnet et al. 2007). Consequently, no access fees for foreign fishing have been received since that time.

Other Government Revenue from Fisheries

Professional fishers are defined as those who are registered, or licensed, and they are issued with a professional identity card. All offshore fishers must be registered, whereas registration for coastal fishers is optional. Those carrying a licence are eligible for a substantial amount of financial assistance. There is no charge for the issue of the licence.

There is a small tax on the export of pearls. In 2009 this tax was changed from XPF 200 per gram to XPF 50 per pearl. In 2010 493 million XPF was collected from this tax (DRMM 2014). Originally, the tax was intended to finance pearl promotion work, but currently the proceeds go the territorial government's general fund (C. Lo, per com. September 2015).

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. DRMM (undated) lists several types of subsidies in each of three fishery categories: lagoon, coastal and offshore.

21.5 Fisheries-Related Employment

DRMM's Statistics Bulletin (DRMM 2015) is an excellent, comprehensive inventory of fisheries and aquaculture production in French Polynesia. By contrast, information on socio-economic aspects of fisheries in the territory is more difficult to locate. A household income and expenditure survey carried out in 2014 may contain fisheries-related employment information, but the results will not be published until mid-2016.

Some recent information on employment in the pearl industry is available (presumably because of the requirement for pearl farm workers to have a professional identity card). A review of labour in French Polynesia by the Institut de la Statistique de la Polynesie Francaise (ISPF 2015) states that the 2014 pearl workforce consisted of 1,060 employees. An ISPF study of the pearl industry (ISPF 2014) states that, at the end of December 2013, there were 815 declared wage earners in pearl farming; however, as many of the pearl farms are run as family businesses, there are likely to be a large number of non-declared workers. The pearl industry also employed 85 people in jewellery production, 116 people in marketing/retailing and 230 in grafting.

An indication of the relative importance of the above employment is that, in 2014, there were 69,800 salaried employees in all of French Polynesia (ISPF 2015). The population of the territory was 262,059 in 2014 (SPC PRISM website).

Some older information is available on fisheries-related employment. Unpublished data from Service de la Pêche (the predecessor of DRMM) is used to construct Table 21-9. The table provides numbers of people involved in fishing activities and non-pearl aquaculture. For 2007 13 people were involved in non-pearl aquaculture, 1800 people in coastal fishing, 1025 in offshore fishing and 200 people in freshwater fishing.

Table 21-9: Employment in Fishing in French Polynesia

	Male/Female	2006	2007
Full time	M	2049	2127
	F	144	86
Part time	M	1589	1658
	F	391	408
Occasional	M	4270	4270
	F	1830	1830
Status not specified	M	200	200
	F		
Total	**M**	**8108**	**8255**
	F	**2365**	**2324**

Units: number of people
Source: Service de la Pêche (unpublished data)

In terms of smaller-scales fishing, the SPC ProcFish programme surveyed five sites in French Polynesia (Kronen et al. 2008). Table 21-10 is an extract from the report of the survey showing the importance of reef fisheries and the sale of fish.

Table 21-10: Involvement with Fisheries at the ProcFish Sites

Island	Households involved in reef fisheries	Households with fisheries as most important source of income
Fakarava	88.0%	12.0%
Maatea	78.6%	17.9%
Mataiea	77.4%	3.2%
Raivavae	93.3%	6.7%
Tikehau	91.7%	37.5%
Average across the five sites	**85.5%**	**14.5%**

Source: Kronen et al. (2008)

SPC (2013) uses ProcFish 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

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 through applying the following estimates:

- Domestic fish production of 9,102 mt, net weight
- Fish imports of 790 mt
- Fish exports of 1,731 mt
- The 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. (2009) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES 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.

Even considering that the two above studies measure different types of consumption (actual food weight versus whole weight equivalent), the results are strikingly different. If the Service de la Pêche results are modified to give whole fish equivalent, the per capita consumption is 46.5 kg per year, compared to 70.3 kg in the Bell et al. study.

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).

The SPC ProcFish programme carried out survey work at five islands (Kronen et al. 2008). That work included estimations of per capita fish consumption. The results (Table 21-11) indicate very high consumption of fresh fish at the sites.

Table 21-11: Fishery Product Consumption at ProcFish Sites (kg/person/year)

Island	Fresh fish consumption	Invertebrate consumption	Canned fish consumption
Fakarava	63.94	2.13	4.13
Maatea	59.91	0.26	5.09
Mataiea	45.13	0.96	2.37
Raivavae	46.42	18.03	3.95
Tikehau	66.59	1.90	4.08
Average accross the 5 sites	**55.55**	**4.91**	**3.95**

Source: Kronen et al. (2008)

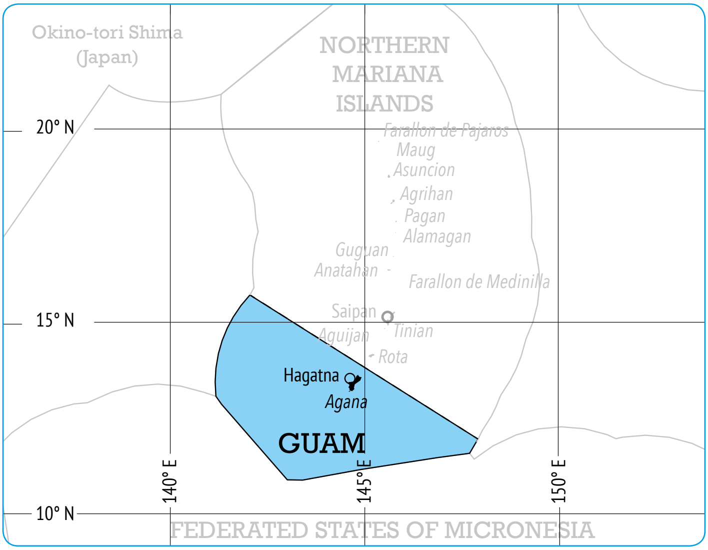
A relatively new source of fish for domestic consumption has become available. Substantial longlining commenced from Tahiti in the early 1990s. In 2014 that fleet captured 5,390 mt of tuna and other pelagic fish, with 1,140 mt of that amount being exported (DRMM 2015). The 4,250 mt of non-exported fish represented about 23.6 kg for each of the 180,000 residents of Tahiti.

21.7 Exchange Rates

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

2000	2001	2002	2003	2004	2005	2006	2007
130	133	127	106	96	96	95	87
2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	
80.0	83.22	90.27	92.16	89.88	86.01	98.13	

22 Guam



22.1 Volumes and Values of Fish Harvests in Guam

Coastal Commercial Catches in Guam

There have been two major attempts to estimate the production of coastal commercial fishing across the Pacific Islands 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 from two Western Pacific Fisheries Information Network annual statistical summaries to estimate an annual coastal commercial fishery production in Guam in the early 1990s of 118 mt.

- Gillett (2009) used information from the Western Pacific Fisheries Information Network and other sources to estimate that the 2007 production from coastal commercial fishing in Guam was 44 mt, worth US$195,000 to the fisher.

Guam focuses more attention on coastal commercial fisheries statistics than any other Pacific Island country or territory. A study of nearshore fisheries management in Micronesia (Rhodes et al. 2011) describes the collection of fisheries data in Guam (Box 22-1).

Box 22-1: The Collection of Fisheries Data on Guam

Fisheries data on Guam are collected via two programs: (1) the creel survey program and (2) total commercial landings. The first, a dedicated program for estimating catch data, is done via creel surveys conducted by the Division of Aquatic and Wildlife Resources (DAWR), through the Guam Department of Agriculture. That program started in the mid-1960s and continues today. In 1982, with support from the Western Pacific Fishery Information Network (WPacFIN), DAWR modified their collection technique and included expansion methods, allowing for island-wide estimates of total catch. In the same year, the second program was implemented by WPacFin in collaboration with DAWR and several local fish dealers and involved the collation and tabulation of total commercial landings through the voluntary use of trip tickets. The Guam Fishermen's Co-operative, the largest and most central distribution point for marketing fresh local fish, has worked with WPacFin in developing a cooperative fishery data collection system providing data that is adjusted using an annual percent coverage factor to create total estimated commercial landings. A summary of the commercial landing data is published yearly.

Source: Rhodes et al. (2011)

Information from the survey of total commercial landing [(1) in the above box] was used to construct Table 22-1 and Table 22-2.

Table 22-1: Guam Estimated 2014 Commercial Landings

Species	Pounds	Kg	Value ($)	Price/Lb.
Null	279	126	785	$2.81
Unknown	25	11	73	$2.94
Bigeye scad (atulai)	1,562	708	3,998	$2.56
Jacks	454	206	1,402	$3.09
Mullets	224	101	676	$3.01
Bottomfishes (unknown)	705	319	2,402	$3.40
Ehu (red snapper)	102	46	433	$4.25
Gindai (flower snapper)	131	59	535	$4.09
Groupers	815	369	2,607	$3.20
Kalikali (pink snapper)	461	209	1,851	$4.02
Lehi (silverjaw)	92	42	384	$4.16
Onaga (red snapper)	336	152	1,978	$5.89
Opakapaka (pink snapper)	264	120	1,124	$4.25
Uku (gray snapper)	174	79	531	$3.06
Amberjack	60	27	184	$3.07
Reef fishes (unknown)	14,177	6,422	46,046	$3.25
Wrasses	22	10	70	$3.25
Rabbitfishes	47	21	152	$3.25
Rudderfish (guilli)	51	23	165	$3.25
Mafute (emperor)	1,453	658	4,509	$3.10
Squirrelfishes	10	5	33	$3.25
Parrotfishes	11,363	5,147	39,423	$3.47
Snappers	76	34	246	$3.25
Surgeonfishes	642	291	2,112	$3.29
Unicornfishes	14,082	6,379	45,738	$3.25
Goatfishes	186	84	604	$3.25
Barracudas	1,529	693	3,271	$2.14
Mahimahi	30,650	13,884	70,044	$2.29
Marlins	23,223	10,520	36,387	$1.57
Spearfish	28	13	42	$1.50
Sailfish	407	184	706	$1.73
Rainbow runner	1,895	858	4,209	$2.22
Wahoo	14,005	6,344	32,986	$2.36
Skipjack tuna	29,259	13,254	57,173	$1.95
Dogtooth tuna	1,271	576	2,291	$1.80
Yellowfin tuna	7,113	3,222	16,630	$2.34
Crabs	42	19	222	$5.32
Lobsters	1,628	737	6,079	$3.73
Octopus	279	126	897	$3.21
TOTAL	**159,121**	**72,082**	**$388,996**	**$2.44**

Source: http://www.pifsc.noaa.gov/wpacfin

Table 22-2: Guam Estimated Commercial Landings, 2011-2104

Year	Pounds	Kg	Value	Price/Lb.
2014	159,121	72,082	$388,996	$2.44
2013	239,514	108,500	$603,188	$2.52
2012	200,275	90,725	$507,286	$2.53
2011	265,483	120,264	$677,765	$2.55

Source: http://www.pifsc.noaa.gov/wpacfin

The estimated total coastal commercial catch on Guam from the tables above is 72 mt, worth US$388,996 to fishers. This is much greater than the 44 mt estimated from the Gillett (2009) study. As noted in the 2009 report, landings in 2007 were unusually low, which is likely to be due to a spike in the cost of fuel.

This assessment of the 2014 production of the coastal commercial fisheries of Guam is probably very accurate compared to those made by the present study for other Pacific Island countries and territories.

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 partitioning 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.

Dalzell et al. (1996) estimated an annual subsistence catch for Guam in the early 1990s of 472 mt. Gillett (2009) estimated subsistence production in 2007 of 70 mt, worth US$217,000 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 tasks of estimating coastal subsistence production is by the subsistence/commercial ratio:

- VanBeukering (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 Aquatics and Wildlife Resources, the subsistence/commercial ratio is about 30/70 (J. Gutierrez and B. Tibbatts, per. com. September 2015).

With the 2011–2014 coastal commercial production averaging 98 mt (table above), the above points suggest a coastal subsistence production of about 42 mt. Using the farm gate approach to valuing subsistence production (i.e. reducing the coastal commercial price by 30%), the subsistence production was worth about US$158,358 to fishers.

Locally Based Offshore Catches

Although several Asian longline vessels transshipped tuna in Guam, those vessels are not considered locally based. For the purpose of the present study it is assumed that in 2014 there was no locally based offshore fishing in Guam.

Foreign-Based Offshore Catches

There is no authorised foreign fishing in Guam zone.

Freshwater Catches

According to staff of the Division of Aquatics and Wildlife Resources, a small amount of eels and *Macrobrachium* is captured in Guam's streams, plus a somewhat larger amount of tilapia in ponds and in Masso Reservoir (J. Gutierrez, per. com. October 2008).

Statistics are not collected on the production from freshwater fishing activities. For the purpose of the present study it is assumed that in 2014 the production from freshwater fishing was 3 mt, worth US$11,000.

Aquaculture Harvests

In August 2008 Guam's Bureau of Statistics and Plans forwarded aquaculture information to FAO, giving a 2007 production of 162 mt, made up of tilapia (100 mt), milkfish (40 mt), catfish (10 mt) and shrimp (12 mt). (Bureau of Statistics and Plans, unpublished data). Since that period the usual compiler of Guam aquaculture information has retired (H. Gong, per. com. October 2015).

An SPC publication (Amos et al. 2014) give estimates of Guam's aquaculture production (Table 22-3).

Table 22-3: Guam Aquaculture Production 2007–2014

	2007	2008	2009	2010	2011	2012
Aquaculture production (mt)	162	162	141	129	111	111
Aquaculture production (thousands US$)	1391	1391	1189	1128	907	907

Source: Amos et al. (2014)

More recent Guam aquaculture statistics are not readily available. The aquaculture specialist at the University of Guam has not made new estimates of aquaculture on the island. That specialist stated there has probably been less production since 2008 because the number of shrimp farms has fallen from four to one, and there is currently less tilapia and catfish visible in the markets. (H. Gong, per. com. October 2015).

The above information is inadequate for making an estimate of the 2014 aquaculture production for Guam. Nevertheless, for the purpose of the present study, the production is deemed to be 100 mt, with a farm gate value[1] of US$800,000.

Summary of Harvests

A crude approximation of the annual volumes and values[2] of the fishery and aquaculture harvests in 2007 can be made from the above sections (Table 22-4).

Table 22-4: Annual Fisheries and Aquaculture Harvest in Guam, 2014

Harvest Sector	Volume (mt)	Value (US$)
Coastal Commercial	72	388,996
Coastal Subsistence	42	158,358
Offshore Locally based	0	0
Offshore Foreign-based	0	0
Freshwater	3	11,000
Aquaculture	100	800,000
Total	**217**	**1,358,354**

The estimates above are judged to be not very accurate, except for the estimate for the coastal commercial fisheries, which appears to be quite good relative to those in this study from other Pacific Island countries and territories.

1 The values on the Guam aquaculture production table are not farm gate values, but rather are prices at "final consumption". Hence, those prices must be deflated to obtain farm gate prices.

2 The values in the table are dockside/farm gate prices.

Figures 22-1 and 22-2 show the volumes and values of the 2014 Guam fisheries production.

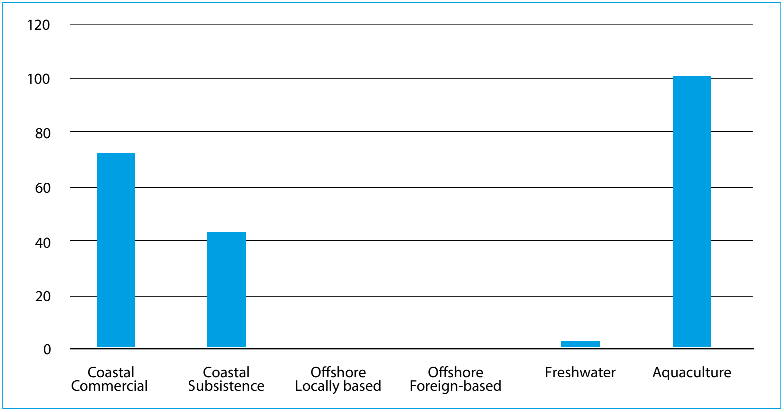


Figure 22-1: Guam Fisheries Production 2014 by Volume (mt)

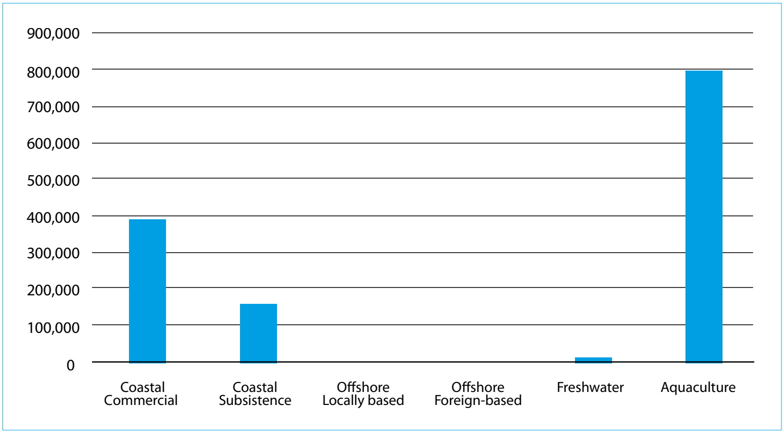


Figure 22-2: Guam Fisheries Production 2014 by Value

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007 and the present study focuses on 2014. The fishery production levels for Guam from those studies are provided in Table 22-5.[3]

3 The earliest Benefish Study, Gillett and Lightfoot (2001), did not include aquaculture, freshwater fisheries or the non-independent territories.

Table 22-5: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, and pcs where indicated)	Nominal Value ($)
Coastal Commercial	1999	n/a	n/a
	2007	44	195,000
	2014	72	388,996
Coastal Subsistence	1999	n/a	n/a
	2007	70	217,000
	2014	42	158,358
Offshore Locally based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Offshore Foreign-based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Freshwater	1999	n/a	n/a
	2007	3	10,000
	2014	3	11,000
Aquaculture	1999	n/a	n/a
	2007	162	948,000
	2014	100	800,000

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

In the above table, the total volume of coastal fisheries production is quite similar between 2007 and 2014. The main difference is in how the total amount is partitioned between commercial and subsistence.

22.2 Contribution of Fishing to GDP

Current Official Contribution

The Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce has made 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$4.756 billion in 2012 and US$4.882 billion in 2013 (BEA 2014).

Method Used to Calculate the Official Fishing Contribution to GDP

Officials of the Guam Bureau of Statistics and Plans are not certain that the BEA GDP estimate for Guam considers the fishing sector (A. Perez and M. Guerrero, per. com. September 2015).

Estimate of Fishing Contribution to GDP

Table 22-6 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 22-4), 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 22-6: Fishing Contribution to Guam GDP in 2014

Harvest Sector	Gross Value of Production (US$, from Table 22-4)	VAR	Value Added (US$)
Coastal Commercial	388,996	0.60	233,398
Coastal Subsistence	158,358	0.75	118,769
Offshore Locally based	0	0	0
Freshwater	11,000	0.85	9,350
Aquaculture	800,000	0.65	520,000
Total	**1,358,354**	---	**881,516**

The contribution of fishing to GDP in 2014 estimated in the table (US$1.36 million) represents about 0.03% of the US$4.882 billion GDP of Guam for 2013.

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 any bona fide fisheries exports are aggregated in the statistics with the transshipped catch of foreign longliners that make port calls in Guam. Bureau of Statistics and Plans (2015) gives the export of "Fish, chilled, fresh, frozen, dried and salted" as US$3.2 million in the last quarter of 2014. Almost all of those fishery exports, if not the entire amount, is likely to be from the transshipping longliners.

The following are possible exceptions to the above:

- An aquaculture specialist at the University of Guam indicated that shrimp broodstock is occasionally exported (J. Brown, per. com. October 2008).
- Staff of the Division of Aquatic and Wildlife Resources indicate that a New York-based aquarium business exports from Guam small amounts of aquarium fish – probably around US$10,000 per year. (J. Gutierrez and B. Tibbatts, per. com. September 2015).

22.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

There is currently no authorised foreign fishing in the Guam zone, and no access fees are paid. United States vessels are considered to be domestic vessels.

Other Government Revenue from Fisheries

Any fishing licensing fees paid by vessels based in Guam go to US government agencies, rather than to the Government of Guam.

22.5 Fisheries-Related Employment

In August 2008 Guam's Bureau of Statistics and Plans forwarded the following fisheries-related employment information to FAO, covering calendar year 2007:

- 1,565 full-time fishers
- 60 part-time fishers
- 170 occasional fishers
- The above includes two people employed full-time in "aquatic-life cultivation"
- All of the jobs above are filled by men (zero are reported to be held by women).

The number of full-time fishers stated above seems very large compared to other surveys. Allen and Bartram (2008), citing a number of studies, show the following:

- The Guam Fishermen's Cooperative membership includes 164 full-time and part-time fishers, and it processes and markets an estimated 80 percent 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.

VanBeukering (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 percent 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.

A community awareness study carried out for the Guam Coastal Management Program covered participation in fisheries (Glimpses Advertising 2012). The results indicated that 49 percent of Guam's population reported participation in fisheries in 2011.

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 June 2014 there were 190 private sector agriculture workers, of which 20 were women.

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.
- 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.
- VanBeukering (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.

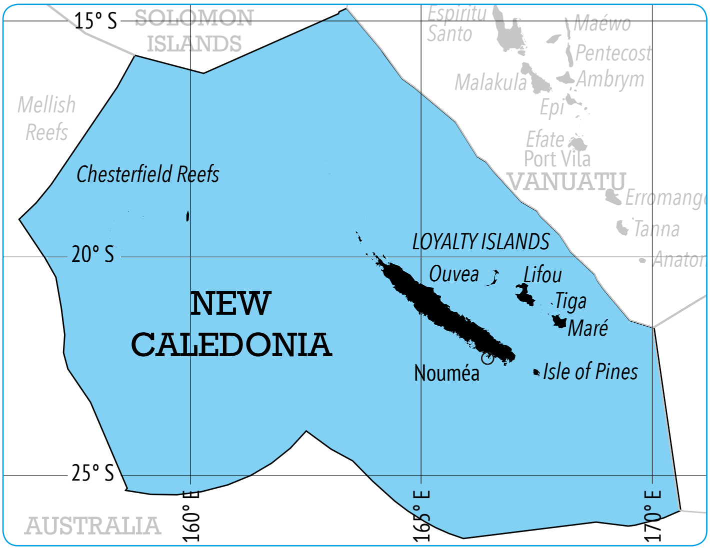
The Development Plan for Aquaculture on Guam (Brown et al. 2010) indicates that the total annual seafood supply obtained is about 8 million pounds (3,624 mt), and per capita consumption is about 45 pounds (20.4 kg) per year, which, given the crudeness of the methods used, is not significantly different 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 for the period 1985–2002 – which include total fish imports, plus reported catches from commercial non-pelagic landings and creel survey landings converted to a per capita basis – range from 21.7 to 22.6 kg per year, which is similar to findings for reef fish consumption in other recent studies.

22.7 Exchange Rates

Guam uses the US dollar (US$).

23 New Caledonia[1]



23.1 Volumes and Values of Fish Harvests in New Caledonia

Coastal Commercial Catches in New Caledonia

The following summarise 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, in estimating a coastal commercial fisheries production of 981 mt (worth US$3,968,650) and a coastal subsistence catch of 2,500 mt (worth US$9,000,000).
- Dupont et al. (2004) estimated annual production for 2002 and 2003: (a) lagoon and coastal commercial fishing: 1,200 mt, 238 fishing

1 The French version of this chapter appears in Appendix 4, page 577 / *La version française de ce chapitre se trouve en page 577 (Appendix 4).*

vessels, 492 fishers; and (b) fishing for home consumption (subsistence and recreational): 3,500 mt.

- Gillett (2009) 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 mt, worth XPF 756 million (Pacific Franc Exchange) at the point of first sale; and (b) the subsistence coastal fisheries production was 3,500 mt, worth XPF 1,372 million to fishers.

The statistics for the declared commercial production compiled by the Direction des Affaires Maritimes (DAM) appear to be reasonably accurate. Problems in estimating total coastal fisheries production occur in trying to extrapolate the declared commercial production to all commercial production, and in estimating the production of coastal subsistence and recreational fisheries. Discussions with fisheries officials and other fishery stakeholders in New Caledonia indicated that Dupont et al. (2004) – a report that synthesizes many aspects fisheries data – is likely to remain the most informative source for the overall production from New Caledonia fisheries.

In the 10 years since the Dupont et al. (2004) study, fisheries officials at the territorial and provincial levels have not observed substantial changes in coastal fisheries production (R. Etaix-Bonnin and T. Tiburzio, per. com. August 2015). While there were some changes caused by dips in the price of nickel and spikes in the cost of fuel, these were not highly significant.

This opinion of lack of change in coastal fisheries production is supported by DAM's declared commercial production statistics, which have remained reasonably constant in the years since the Gillett (2009) study. The DAM statistics show a total reef and lagoon fishery production of 569 mt in 2008 and 544 mt in 2013 (the latest year for which published statistics are available). (DAM 2014)

However, prices have increased. DAM (2014) shows that the total value of the declared reef and lagoon fishery production increased by 21% in the period between the Gillett (2009) study and 2013.

From the above readily available information on coastal fisheries production in New Caledonia, it appears that the most appropriate approach for estimating total production is to assume no change in the volume of coastal fisheries production since the Gillett (2009) study, and a 21% increase in the value. Accordingly, in New Caledonia in 2014, it is estimated that: (a) the coastal commercial fisheries production was 1,350 mt, worth XPF 915,000,000 at the point of first sale; and (b) the subsistence coastal fisheries production was 3,500 mt, worth XPF 1,660,000,000 to fishers.

Coastal Subsistence Catches

For the purpose of this study, the catches from recreational fishing are considered as production for home consumption and therefore as a component of subsistence fisheries.

Following the approach in the coastal commercial section above, it is assumed that the volume of the coastal subsistence catch remains unchanged from the Gillett (2009) study, but that the value has increased by 21%.

It is estimated that, in 2014, the subsistence fisheries production in New Caledonia was 3,500 mt, worth XPF 1,660,000,000 to fishers.

Locally Based Offshore Catches

There appears to be very good data available on the catches of New Caledonia-based offshore fishing vessels. 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. 2015) states:

> Fishing for tuna and associated species by New Caledonian vessels started in 1981 with pole-and-line (less than 3 vessels) which stopped very rapidly (1981: 228 mt; 1982: 998 mt; 1983: 492 mt). Some domestic longliners started operating at the same time and it took almost 20 years before this domestic fleet had a significant activity. This fleet operates in the New Caledonian EEZ, and very rarely fishes in the adjacent high seas. In 2014, all of the 17 licensed domestic longliners were active. Similarly to past years there were no foreign vessels licensed or chartered to operate in the New Caledonian EEZ.

Table 23-1: Locally Based Offshore Catches (mt)

	2012	2013	2014
Albacore	1,751	1,732	1,630
Yellowfin	573	531	741
Bigeye	41	51	58
Marlin	154	104	123
Swordfish	10	9	14
Mako shark	10	2	0
Others	260	261	310
Total	**2,796**	**2,691**	**2,876**

Source : DAM (2014) and Anon. (2015)

As to the value of the catch, the annual offshore fishing report by Direction des Affaires Maritimes (DAM 2014) states that that the value at first sale of the offshore catch in 2013 was XPF 1,135 million (XPF 420 per kg). As at December 2015 the annual report for 2014 was not available. However, information in ISEE (2015) indicates that the export value of the 2014 offshore catch had increased by 16% from 2013. Accordingly, for the purpose of the present study it will be assumed that the total catch value had also increased by 16%.

It is estimated that the 2014 catch by the locally based offshore fleet was 2,876 mt, worth XPF 1,316,600,000.

Foreign-Based Offshore Catches

In the paper presented by New Caledonia to the 4th Scientific Committee Meeting of the Western and Central Pacific Fisheries Commission (Anon. 2008) it is stated that no licences to fish have been issued to foreign vessels since early 2001. The absence of authorised foreign fishing in the New Caledonia zone in recent years is confirmed by New Caledonia's paper to the 11th Scientific Committee, in August 2015 (Anon. 2015).

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. August 2015).

A crude estimate of the annual harvest would be about 10 mt. Valuing this production similarly as with the production of coastal subsistence fisheries production, above, the 10 mt would be worth XPF 4,743,000.

Aquaculture Production

Aquaculture in New Caledonia is dominated by shrimp farming. There is also the culture of much smaller amounts of gigas oysters and freshwater crayfish. There are reports of experimental culture of rabbitfish and beche de mer.

Shrimp culture began in New Caledonia in the early 1980. Production increased until 2006, then declined until 2010, and has recovered somewhat since. About 60% of the production is exported, with three-quarters of exports for the Japanese market.

- The annual report of commercial fishing and aquaculture (DAM 2014) states that, in 2013, there were 18 shrimp farms, 94 ponds and 670 hectares in production. The harvest was 1,570 mt, with an average price at first sale of XPF 1,050 per kg (XPF 1,648,500,000 in total value).
- As of December 2015 the annual report had not been published. However, information in ISEE (2015) indicates that the 2014 shrimp harvest was 1,670 mt. Using the 2013 prices at first sale, the value of the 2014 shrimp harvest is estimated to be about XPF 1,753,500,000.

The annual production of freshwater crayfish is between 3 to 4 mt, and for gigas oysters between 40 and 80 mt (DAM unpublished data). The price at first sale for both commodities in 2014 is estimated to be XPF 90 million.

The total aquaculture production for New Caledonia in 2014 is estimated to be 1,733 mt, with a value at first sale of XPF 1,843,500,000.

Summary of Harvests

An approximation of the annual volumes and values at point of first sale of the fisheries and aquaculture harvest in New Caledonia in 2014 is given in Table 23-2.

Table 23-2: Annual Fisheries and Aquaculture Harvest in New Caledonia, 2014

Harvest Sector	Volume (mt)	Value (XPF)
Coastal Commercial	1,350	915,000,000
Coastal Subsistence	3,500	1,660,000,000
Offshore Locally based	2,876	1,316,600,000
Offshore Foreign-based	0	0
Freshwater	10	4,743,000
Aquaculture	1,733	1,843,500,000
Total	**9,469**	**5,739,843,000**

The poor factual basis for the production estimates from coastal commercial and coastal subsistence is acknowledged.

Figures 23-1 and 23-2 show the volumes and values of the 2014 New Caledonia fisheries production.

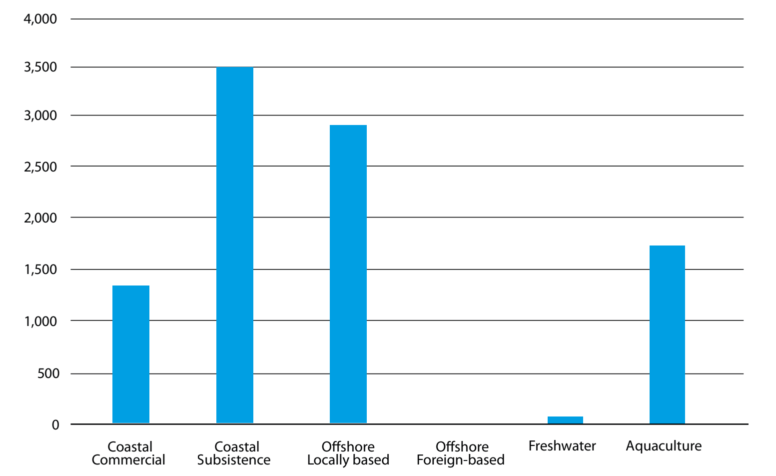


Figure 23-1: New Caledonia Fisheries Production 2014 by Volume (mt)

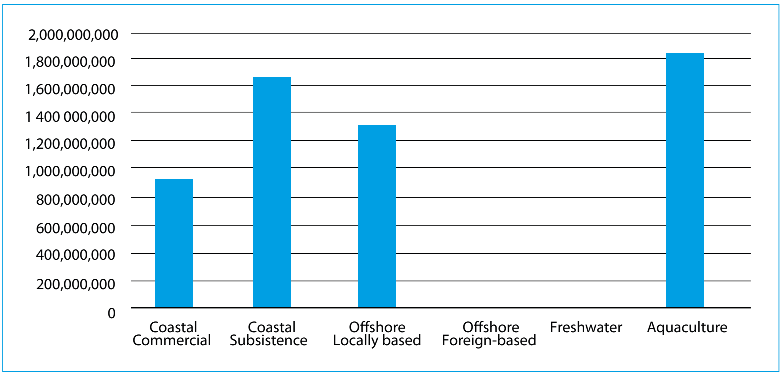


Figure 23-2: New Caledonia Fisheries Production 2014 by Value (XPF)

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007 and the present study focuses on 2014. The estimated fishery production levels for New Caledonia from those studies are presented in Table 23-3.[2]

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

Table 23-3: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Type de pêche	Estimate Year	Volume (mt)	Nominal Value (XPF)
Coastal Commercial	1999	n/a	n/a
	2007	1,350	756,000,000
	2014	1,350	915,000,000
Coastal Subsistence	1999	s/o	s/o
	2007	3,500	1,372,000,000
	2014	3,500	1,660,000,000
Offshore Locally based	1999	n/a	n/a
	2007	2,122	745,000,000
	2014	2,876	1 316 600 000
Offshore Foreign-based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Freshwater	1999	n/a	n/a
	2007	10	3,992,000
	2014	10	4,743,000
Aquaculture	1999	n/a	n/a
	2007	1,931	1,443,700,000
	2014	1,733	1,843,500,000

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

The apparent changes in production between years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the production is measured (hopefully an improvement). In the table above, the volumes of production for coastal commercial, coastal subsistence, and freshwater do not change between the years because there are no new production data and no anecdotal information suggesting changes. 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

2010 is the latest year for which an official and detailed GDP estimate has been made for New Caledonia. Although some provisional estimates have been made up to 2013, the detailed contributions by economic sectors are not yet publicly available.

Staff of the Institut de la Statistique et des Etudes Economique provided unpublished data that show the contribution of fishing and aquaculture to the 2010 New Caledonia current price GDP (Table 23-4).

Table 23-4: Fishing and Aquaculture Contribution to GDP, 2010 (XPF millions)

	Value of production	Value added
Fishing	4,155	1,236
Aquaculture	1,738	127
Total fishing and aquaculture	5,893	1,363

Source: ISEE (unpublished data)

With a GDP of XPF 842,913 million in 2010 (ISEE 2014), the fishing and aquaculture contribution represents about 0.16% of GDP.

Method Used to Calculate the Official Fishing Contribution to GDP

Discussions with ISEE staff and subsequent correspondence produced some insight on the methodology for calculating the fishing and aquaculture contribution to GDP (L. Bertoux, per. com. October 2015). The following summarise some aspects of the methodology:

- For aquaculture, the production and intermediate consumption come from the tax declarations of the companies involved.
- For professional fishing the data comes from the Direction des Affaires Maritimes.
- Non-professional fishing is assumed to be about 3,500 mt per annum – a figure that comes from a 1998 household income and expenditure survey.

An examination of the table above shows value added ratios of fishing (VAR of .30) and aquaculture (VAR of .07). These ratios appear low. Because ISEE has access to aquaculture company accounts, it is assumed that the low VARs are accurate. The low VAR for the fishing category in the table may be unrealistic in view of the fact that the largest component of the fishing category is subsistence fishing, with a characteristically high VAR. The present study uses a VAR of .80 to .90 for marine subsistence fishing. Some work on VARs specifically for New Caledonia has been carried out by Dupont et al. (2004) and appears in Table 23-5.

Table 23-5: Value Added Ratios for Some Types of Fishing in New Caledonia

Activity/Location	VAR
Small boat fishing in New Caledonia; outboard vessels 3.4 to 4.5 m in length	0.65
Small boat fishing in New Caledonia; outboard vessels 5.5 to 7 m in length	0.80
Small boat fishing in New Caledonia; inboard vessels 7 to 8 m in length	0.65
Small boat fishing in New Caledonia; inboard vessels 8.4 to 11.96 m in length	0.60

Source: Dupont et al. (2004)

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 23-2), and determines the value added by using value added (VARs) that are ratios 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 2014 Using an Alternative Approach

Harvest Sector	Gross Value of Production (XPF, from Table 23-2)	VAR	Value Added (XPF)
Coastal Commercial	915,000,000	0.65	594,750,000
Coastal Subsistence	1,660,000,000	0.80	1,328,000,000
Offshore Locally based	1,316,600,000	0.20	263,320,000
Freshwater	4,743,000	0.90	4,268,700
Aquaculture	1,843,500,000	0.45	829,575,000
Total (CFP)	**5,739,843,000**	---	**3,019,913,700**

Source: Table 23-2, 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 886 billion in 2013 (ISEE 2014). It is clearly not methodologically appropriate to compare the value added from fishing and aquaculture in 2014 to the GDP in 2013, but solely for illustrative purposes, fishing and aquaculture for 2014 represents 0.34% of the GDP of the previous year. This is about twice the official contribution of fishing/aquaculture to GDP in 2010. Most of this difference arises from the relatively low value added ratios used in the official calculations.

23.3 Exports of Fishery Production

The Institut de la Statistique et des Etudes Economique tracks New Caledonian exports, including fishery exports. This data is illustrated by value in Table 23-7, and by volume in Table 23-8.

Table 23-7: Value of Fishery Product Exports (XPF millions)

	2010	2011	2012	2013	2014
All fishery products	1,806	1,832	1,942	2,053	2,173
Tuna	431	437	413	265	253
Shrimp	1,025	1,013	1,145	1,302	1,435
Beche de mer	181	287	260	342	389
Trochus shells	104	68	86	106	61
Other	65	27	38	38	35
Total New Caledonia exports	134,530	143,904	123,039	110,189	144,309

Source : ISEE (2015)

Table 23-8: Volume of Fishery Product Exports (mt)

	2010	2011	2012	2013	2014
All fishery products	2,131	1,749	1,834	1,943	1,793
Tuna	1,095	844	779	775	636
Shrimp	746	708	817	868	958
Beche de mer	26	34	31	42	52
Trochus shells	228	144	175	227	127
Other	36	19	32	31	20

Source: ISEE (2015)

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 have increased during the five-year period. The second-most important fishery export is beche de mer, but exports of that commodity have decreased during the five-year period.

Unlike other Pacific Island countries or territories that have locally based longliners, the majority of the tuna catch in New Caledonia is not exported but is consumed domestically. In 2014 only about one-quarter of the tuna catch was exported. About 57% of cultured shrimp was exported.

23.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

No licences to fish have been issued to foreign vessels since early 2001 (Anon. 2008) and, consequently, no fees have been paid for fishery access.

Other Government Revenue from Fisheries

In general, in New Caledonia the fisheries sector is not revenue generating, but rather is subsidy absorbing, as a variety of subsidies are available for the various fisheries sub-sectors.

23.5 Fisheries-Related Employment

In New Caledonia there is good information available on employment on locally based offshore fishing vessels and associated shore-based activities. There is also data on registered commercial fishers and aquaculture workers, but there is much less information on non-registered commercial fishers and participants in subsistence fishing activities.

ISSS (2015) summarises the information on registered commercial fishers (Table 23-9).

Table 23-9: Numbers of Registered Commercial Fishers[3]

	2000	2005	2010
Coastal and lagoon fishing	**694**	**412**	**613**
Province Sud	348	172	92
Province Nord	286	149	480
Province Îles Loyauté	60	91	41
Offshore fishing	**99**	**162**	**120**
Province Sud	99	102	93
Province Nord	0	60	27
Total coastal/lagoon/offshore	793	574	733

Source : ISEE (2015)

3 An individual familiar with New Caledonia fisheries estimated that the number of non-registered commercial fishers is approximately equivalent to those that are registered (B . Fao, per. com. August 2008).

DAM (2011) examines offshore fisheries-related employment more closely, and converts the number of jobs to full-time equivalents. This is shown Table 23-10. Although data expressed as FTEs is important in making comparison between years and countries, few (if any) other countries or territories in the present study express fisheries-related employment in this manner.

Table 23-10: Offshore Employment in 2010

		Number of jobs	Full time equivalent
AT SEA	Captains	10	9.5
	Chief engineers	14	12.1
	Engineers	6	6.0
	Deck crew	94	80.3
	Total	**124**	**108.7**
ASHORE	Fleet manager	7	6.4
	Assistant fleet manager	4	3.3
	Secretary	4	2.6
	Accountant	5	2.4
	Chief technician	1	1.0
	Maintenance technicians	9	9.0
	Unloading crew	3	3.0
	Maintenance workers	1	0.5

Units are number of occupied jobs
Source: DAM (2011)

A newer study updates the offshore employment information and provides more detail (DAM 2014). This study estimates that, in 2013, there were 120 onboard crew, 30 people in onshore vessel management, 60 people in processing, and 20 people in fish wholesaling: representing 230 people.

Unpublished ISEE data is available on employment, using payroll data (Table 23-11). It is assumed that these data give the number of formally employed fisheries wage earners. This data includes aquaculture employment.

Table 23-11: Number of Fisheries Jobs, from Payroll Data

	2010	2011	2012	2013	2014
Marine fishing	228	249	245	238	228
Freshwater fishing	0	0	0	0	0
Marine aquaculture	154	169	170	190	199
Freshwater aquaculture	0	0	0	0	0
Total	**382**	**417**	**415**	**428**	**426**

Source: ISEE (unpublished data)

The ISEE website[4] indicates that there were 91,440 salaried employees in New Caledonia in 2014. The 426 people employed in fisheries, shown in the table above, represent 0.47% of salaried employees in New Caledonia.

Some information is available on the age structure of fishers, as follows:

- A study in Province Sud of 82 fishing captains revealed that, in 2013, the average age of captains was 52 years, about 30% were aged over 60, and 43% were aged under 50 (Province Sud 2014).
- 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 was 50 years. (CNPMEM 2013).

There appears to be less information available on non-commercial fishing in New Caledonia. Virly (2000) gives the results of a study of subsistence fishing in New Caledonia. 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.

The SPC ProcFish programme surveyed five sites in New Caledonia (Kronen et al. 2009). Table 23-12 is an extract from the report of the survey, showing the importance of both reef fisheries and the sale of fish. These sites were not intended to be representative of all sites in the country, but rather representative of sites having active reef fisheries.

Table 23 -12: Involvement with Fisheries at SPC ProcFish Sites

Site	Households involved in reef fisheries	Households with fisheries as most important source of income
Ouassé	100 %	0 %
Thio	97.6 %	47.6 %
Luengoni	90.0 %	6.7 %
Oundjo	100 %	50.0 %
Moindou	90.0%	12.5%
Average across the five sites	94.6 %	27.0 %

Source : Kronen *et al.* (2009)

4 http://www.isee.nc/economie-entreprises/entreprises-secteurs-d-activites/agriculture-peche-aquaculture [accessed 8 April 2016]

SPC (2013) uses ProcFish data to examine the ratio of men to women fishers across the Pacific. For the New Caledonia sites examined, about 65% of fishers were men and 35% were women.

23.6 Levels of Fishery Resource Consumption

Dupont et al. (2004) indicate that, in 2003, 4,632 mt 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.

A representative of Direction des Affaires Maritimes was not aware of any more recent studies on fish consumption specifically focused on New Caledonia (R. Etaix-Bonnin, per. com. August 2015).

Bell et al. (2009) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in the Pacific Island region. The HIES 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.

The SPC ProcFish programme carried out survey work at five sites in New Caledonia (Kronen et al. 2009). That work included estimates of per capita fish consumption (Table 23-13). The sites were not intended to be representative of all sites in the territory, but rather to be representative of sites having active reef fisheries. Compared to other ProcFish sites across the Pacific, the nominal per capita invertebrate consumption was relatively high, and was very high relative to the fresh fish consumption at the New Caledonia sites.

Table 23-13: Fishery Product Consumption at ProcFish Sites (kg/person/year)

Site	Fresh fish consumption	Invertebrate consumption	Canned fish consumption
Ouassé	20.74	14.25	5.36
Thio	21.57	34.99	4.68
Luengoni	36.21	5.25	18.05
Oundjo	34.39	46.12	5.82
Moindou	32.95	23.47	1.17
Average across the five sites	29.81	26.46	6.69

Source : Kronen et al. (2009)

A relatively new source of fish for domestic consumption has become available. Longlining started in Noumea in the early 1980s, but in the mid-1990s the fleet was reduced to just two vessels (DAM 2013). In 2014 that fleet (by then 17 vessels) captured 2,876 mt of tuna and other pelagic fish (Anon. 2015), with only 253 mt of that amount being exported (ISEE 2015). The 2,624 mt of non-exported fish in 2014 represented about 26.2 kg for each of the 100,000 residents of Noumea.[5]

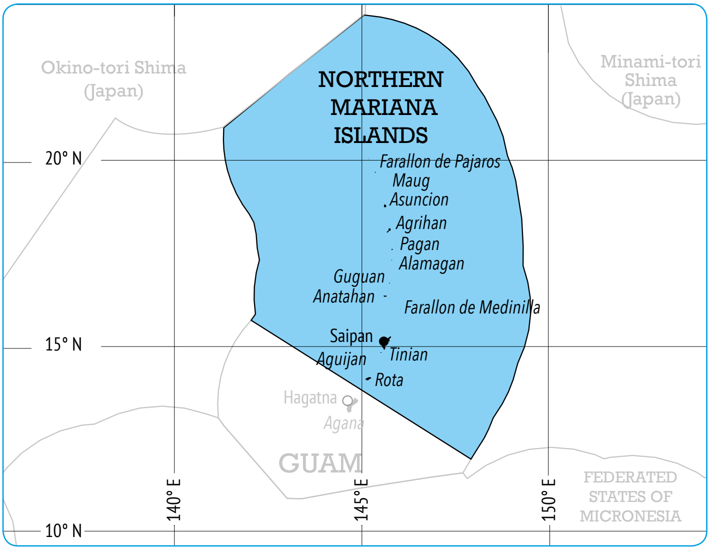
23.7 Exchange Rates

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

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
96	96	95	87	80.0	83,22	90,27	92,16	89,88	86,01	98,13

5 A Noumea-based fisheries specialist indicated that albacore is one of the basic foods "sponsored" by the government to mitigate the "expensive life" ("La vie chère"). This was indicated as the main reason why there is a high consumption of albacore by Noumea residents: approximately XPF 1200/ kg for albacore fillets at the time of the communication, which was about half the price of beefsteak (A. Desurmont, per. com. January 2016).

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

There have been two major attempts to estimate the production of coastal commercial fishing across the Pacific Islands region that have included the Commonwealth of the Northern Mariana Islands (Northern Marianas, or CNMI, in this report). The results of those studies that deal with coastal commercial fisheries of CNMI are summarised below:

- 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 mt, worth US$613,804.

- Gillett (2009) used a 2008 WPacFIN report to estimates that the 2007 production from coastal commercial fishing in CNMI was 231 mt, worth US$950,000 to fishers.

In addition to the above studies, there have been several other estimates of coastal fisheries production in the Northern Marianas, 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 partitioning the production between commercial and subsistence components; and (d) there are different ways of adjusting the WPacFIN survey results to produce total fisheries production.

To explore the coastal fisheries production of the Northern Marianas, it is helpful to have knowledge of the various fisheries in the area and of the current fisheries statistical situation. A study of nearshore fisheries management in Micronesia (Rhodes et al. 2011) summarises the coastal fisheries of the area (Box 24-1), and a report covering the social, cultural and economic importance of fishing in CNMI (Allen and Amesbury 2012) describes the fisheries data situation (Box 24-2).

Box 24-1: The Fisheries of the Northern Marianas

Extensive commercial fisheries are developed in the southern CNMI islands (Saipan, Tinian, Rota, and Anguijan); however, most fishing activity is centered around Saipan (62,392 inhabitants), the capital of the CNMI. Saipan-based boats also frequent the coastal waters of Tinian (population 3,540), Aguijan (uninhabited), and, less often, Rota (population 3,283). In the CNMI, reef fish are mainly harvested through nighttime spearfishing (>80%), followed in rank by hook-and-line. Both gillnets and SCUBA spearfishing are illegal; however, current legislation aims to release the ban on gillnets. In Saipan, several professional, locally owned fishing operations supply markets in Saipan. These operations each consist mainly of 3-4 full-time, low-paid, non-resident workers that have catch-based incentives as part of their salary. A few of the fishing operations are market-owned, while other fishing operations remain independent. Most professional operations will travel as far as Rota (70-120 km), but typically fish in Saipan, Aguijan, or Tinian. The remaining contributions of marketed landings come from "semi-subsistence" CNMI fishermen that sell a portion of their catch to generate additional income. These operations are usually land-based (i.e., no boat used) and typically operate at night. The amount of reef fish sold in Saipan-based markets in 2009 was estimated at 55 mt, with a total market value of almost half a million dollars. Subsistence catch could be up to 4-5 times the commercial volume, with over 16% of households actively fishing.

Source: Rhodes et al. (2011)

Box 24-2: The Fisheries Statistics of the Northern Marianas

There are currently no requirements for commercial fishing vessel, operator, or crew licenses for inshore or offshore waters of CNMI. All data collection efforts are on a voluntary basis. Since the mid-1970s, the CNMI Division of Fish and Wildlife (DFW) has been collecting data on fishing in Saipan. DFW later expanded its fisheries monitoring programs to include Rota and Tinian. DFW distributes and collects invoice books from participating fish purchasers on Saipan. These records encompass approximately 90% of all commercial fishing. The Western Pacific Fisheries Information Network (WPacFIN) compiles and expands the data to represent the entire CNMI. The data from 1983 and later are considered the most accurate. DFW's principal method of collecting domestic commercial fisheries data is a dealer invoicing system, sometimes referred to as a trip ticket system. The DFW provides numbered two-part invoices to all purchasers of fresh fishery products (including hotels, restaurants, stores, fish markets, and roadside vendors). Dealers then complete an invoice each time they purchase fish directly from fishers; one copy goes to DFW and one copy goes to their records.

Source: Allen and Amesbury (2012)

The data collection described above, as applied to the year 2014, results in estimates of commercial landings provided in Table 24-1.

Table 24-1: The WPacFIN Northern Marianas Estimated Commercial Landings in 2014

Species	Pounds	Metric tonnes	Value US$)	Price/ Lb.(US$)
Miscellaneous	105	0.05	$282	$2.67
Bigeye scad	2,453	1.11	$6,610	$2.69
Jacks	573	0.26	$1,568	$2.73
Mullet	102	0.05	$261	$2.57
Black jack	122	0.06	$312	$2.57
Giant trevally	4	0.00	$17	$4.00
Bottomfishes (unknown)	4,208	1.91	$14,151	$3.36
Sickle pomfret	257	0.12	$691	$2.69
Ehu (red snapper)	804	0.36	$3,149	$3.92
Gindai (flower snapper)	583	0.26	$2,457	$4.21
Groupers	573	0.26	$2,861	$4.99
Kalikali (yellowtail)	1,052	0.48	$3,438	$3.27
Onaga (red snapper)	5,623	2.55	$34,519	$6.14
Opakapaka (pink snapper)	1,980	0.90	$7,638	$3.86
Jobfish (uku)	1,796	0.81	$5,630	$3.13
Silvermouth (deep lehi)	1,095	0.50	$3,834	$3.50

Table 24-1: continuation

Species	Pounds	Metric tonnes	Value US$)	Price/ Lb.(US$)
Amberjack	881	0.40	$2,295	$2.61
White lyretail grouper	200	0.09	$472	$2.36
Blue lined snapper	296	0.13	$830	$2.80
Red snapper	73	0.03	$291	$4.00
Wrasses	104	0.05	$299	$2.88
Rabbitfishes	2,964	1.34	$9,112	$3.07
Emperors	2,783	1.26	$8,348	$3.00
Squirrelfishes	1,169	0.53	$3,250	$2.78
Parrotfishes	10,762	4.88	$34,110	$3.17
Surgeonfishes	1,228	0.56	$3,149	$2.56
Orangespine unicornfish	1,827	0.83	$5,239	$2.87
Unicornfishes	1,280	0.58	$3,555	$2.78
Goatfishes	3,595	1.63	$10,046	$2.79
Yellowfin surgeonfish	46	0.02	$92	$2.00
Pelagic fishes (unknown)	1,025	0.46	$2,780	$2.71
Barracudas	155	0.07	$328	$2.11
Mahimahi	37,314	16.90	$84,843	$2.27
Blue marlin	2,416	1.09	$5,242	$2.17
Sailfish	87	0.04	$160	$1.84
Rainbow runner	1,392	0.63	$3,115	$2.24
Wahoo	7,232	3.28	$17,704	$2.45
Skipjack tuna	157,571	71.38	$363,234	$2.31
Dogtooth tuna	4,928	2.23	$11,126	$2.26
Yellowfin tuna	15,022	6.80	$35,197	$2.34
Kawakawa (saba)	1,813	0.82	$3,628	$2.00
Invertebrates	5,683	2.57	$49,041	$8.63
Octopus	581	0.26	$1,587	$2.73
Squid	39	0.02	$196	$5.00
TOTAL	**283,797**	**128.56**	**$746,687**	**$2.63**

Source: http://www.pifsc.noaa.gov/wpacfin/cnmi/Pages/cnmi_data_2.php

Table 24-2: The WPacFIN Northern Marianas Estimated Commercial Landings, 2011–2104

Species	Pounds	Metric tonnes	Value (US$)	Price/Lb. (US$)
2014	283,797	128.56	$746,687	$2.63
2013	315,054	142.72	$739,646	$2.35
2012	230,310	104.33	$526,543	$2.29
2011	217,092	98.34	$503,821	$2.32
2010	285,378	129.28	$608,970	$2.13

Source: http://www.pifsc.noaa.gov/wpacfin

Various fisheries specialists have commented on the accuracy and validity of the WPacFIN Northern Marianas estimates, summarised below:

- Cuetos-Bueno and Houk (2014) stated that the proportion of reported catch relative to the "real" total catch is not adequately quantified. However, through local expert judgment, the reported catches can be adjusted by applying a factor of 10% to account for fish not recorded in the database, thus providing estimates of total commercial landings in CNMI.
- Rhodes et al. (2011) indicated that the dependence upon a voluntary, receipt-based data collection system may limit representativeness and accuracy. Several studies have suggested that the data collection methods may have introduced influential deficiencies that have led to underestimating the actual catch.
- The monitoring of commercial purchases is associated with numerous difficulties (J. Gourley, per. com. September 2015).

The Cuetos-Bueno and Houk (2014) study appears have carried out the most comprehensive examination of past efforts to estimate total coastal fisheries production in the Northern Marianas. This included scrutinising four studies on commercial fishing and five sources of subsistence fishing information. The study concludes:

> Conservative and non-conservative estimates of modern catch volumes in the CNMI were calculated by combining the commercial landings derived from the present Saipan-based Nutritional Assistance Program[1] datasets (expanded by 10 % to account for sales made outside of the island of Saipan; Hamm et al. 2010), with the non-commercial landings derived from van Beukering et al. (2006). The non-conservative estimate for total reef

1 This is a United States Department of Agriculture food coupon program.

> fish landings during the mid-2000s was 514 mt per year, while a more conservative estimate that accounts for potential perception biases in the fishermen interviews (i.e., a 50 % reduction) was 257 mt/year… Present evidence introduced from socioeconomic surveys suggested that non-commercial fisheries were between five and nine times commercial counterparts in the mid-2000s.

In considering the above fisheries production information it must be noted that: (1) the results are applicable to the mid-2000s; and (2) the study is focussed on "reef fish landings", which is a subset of all landings from coastal fishing.

With regard to the two points above:

- in the period 2007 to 2014 the resident population of the Northern Marianas declined by 13.8%;
- the last garment factory closed in 2008. With the decline in garment workers there has been less demand for fish (J. Gourley, per. com. September 2015);
- the number of commercial fishers (full-time or part-time) and seafood purchasers, as well as total commercial landings, have decreased over the long term in response to downturns in the domestic economy. Pelagic participation peaked in the mid-1980s and then grew again in the mid-1990s, and dropped again in the early 2000s. (information from various sources cited in Allen and Amesbury [2012]);
- research by fisheries specialists from the University of Guam indicates that there was a near-40% decrease in the landings of pelagic fish by coastal fishers from 2006 to 2011 (J. Cuetos-Bueno, per. com. January 2016); and
- in the above table, for WPacFIN Northern Marianas Estimated Commercial Landings in 2014, the reef fish component of the landings (i.e. the total minus the pelagic fish) is about 20% of the total commercial landings.

From the table above, the WPacFIN Northern Marianas Estimated Commercial Landings in 2014 were about 128.56 mt, worth about US$746,687. The approach taken in the present study in estimating total coastal commercial fishery production in CNMI is to expand that volume and value by 10%, as suggested by the Cuetos-Bueno and Houk (2014) study (to account for off-Saipan sales). This results in 2014 CNMI coastal commercial fisheries production of about 142 mt, worth US$821,356.

Coastal Subsistence Catches

Zeller et al. (2007) used a statement in a 1947 report to estimate subsistence fish production in CNMI in 1950 of 456 mt:

> 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).

This statement (of unknown accuracy), and the associated estimate of 456 mt in subsistence catches, are key in Zeller et al. (2007) establishing a "data anchor point". This and other data points were used to "reconstruct" coastal catch data for the period 1982 to 2002. Their catch estimate for CNMI's non-commercial fisheries in 2002 was 106 mt.

Dalzell et al. (1996) estimated a subsistence catch of 2,825 mt (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 (DFW) 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:

> The ultimate disposition of catch from CNMI fishermen reflects the diverse social, cultural, and economic motivations for fishing. Approximately 28% of fish catch was reported to be consumed at home, while 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 mt per year in the 1950s to around 100 mt per year in the early 2000s. They also re-assessed the Van Beukering et al. (2006) study, and concluded subsistence reef fisheries production for CNMI of between 235 mt and 470 mt for the mid-2000s.

It should be noted that: (1) coastal fisheries production is likely to have declined in the decade since the focus period of the above study; (2) the above study was confined to subsistence reef fish catches (i.e. it did not consider pelagic fish catches); and (3) Hospital and Beavers (2014) reported a significant proportion of pelagic and deep-bottom fishing activities as non-commercial.

Subsistence fisheries production in CNMI in 2014 was likely to have been around 350 mt. Using prices in the above table, and the farm gate method for valuing subsistence production, that volume of fish was worth about US$1.4 million to fishers.

Locally Based Offshore Catches

The last locally based offshore fishing operation in the Northern Marianas is described by Allen and Amesbury (2012) in Box 24-3.

Box 24-3: The Rise and Fall of Locally Based Offshore Fishing in the Northern Marianas

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 to 2015 there was no locally based offshore fishing in the Northern Marianas.

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 Commonwealth of the Northern Mariana Islands Aquaculture Development Plan 2011–2015 (Northern Marianas College 2011) provides information on aquaculture production:

> 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. 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). Three strains of tilapia are currently in production: the Chitralada variety from Thailand (Oreocrhomis niloticus), red Thai Variety (Red Hybrid), and Pearl White Variety.

The aquaculture specialist at the Cooperative Research Extension and Education Service of Northern Marianas College (M. Ogo, per. com. November 2014) kindly provided information on recent aquaculture production in CNMI, as follows:

- The shrimp Litopenaus vannamei for Saipan and Guam markets: 2014 production was about 25 tons,[2] valued at US$9 per pound.
- Litopenaeus broodstock for export: 2014 production was about 15,000 pieces, at US$40 per piece.

2 This is assumed to be a "short ton" (i.e. 2,000 pounds).

- Tilapia (both live and fresh) sold in stores, farmers' markets, and direct to customers' doors: 2014 production was about 40,000 pounds, with a farm gate price of about US$2 per pound.
- The total 2014 aquaculture production was about 90,000 pounds (40,770 kg), and 15,000 pieces, with a farm gate value of US$1,130,000

Summary of Harvests

A crude approximation of the annual volumes and values[3] of the fishery and aquaculture harvests in 2014 can be made from the above sections (Table 24-3).

Table 24-3: Annual Fisheries and Aquaculture Harvest in CNMI, 2014

Harvest Sector	Volume (mt, and pcs where indicated)	Value (US$)
Coastal Commercial	142	821,356
Coastal Subsistence	350	1,400,000
Offshore Locally based	0	0
Offshore Foreign-based	0	0
Freshwater	0	0
Aquaculture	41 mt and 15,000 pcs	1,130,000
Total	**533 mt and 15,000 pcs**	**3,351,356**

Figures 24-1 and 24-2 show the volumes and values of 2014 CNMI fisheries production. Aquaculture is not shown on the volumes figure, due to the use of mixed units (pieces and mt).

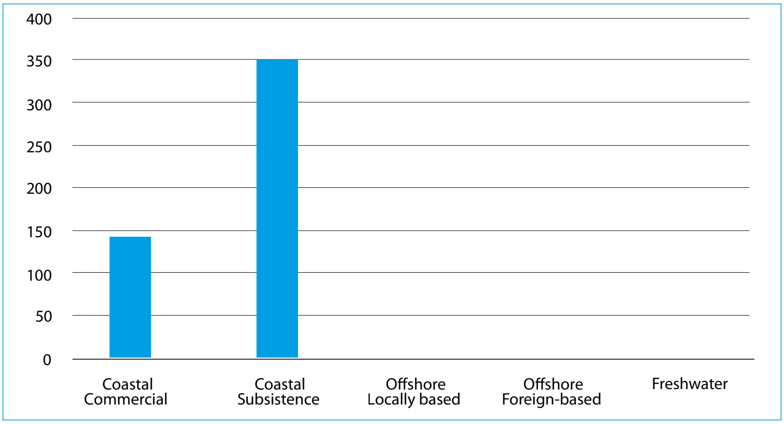


Figure 24-1: Northern Marianas Fisheries Production by Volume (mt), 2014

3 The values in the table are dockside/farm gate prices.

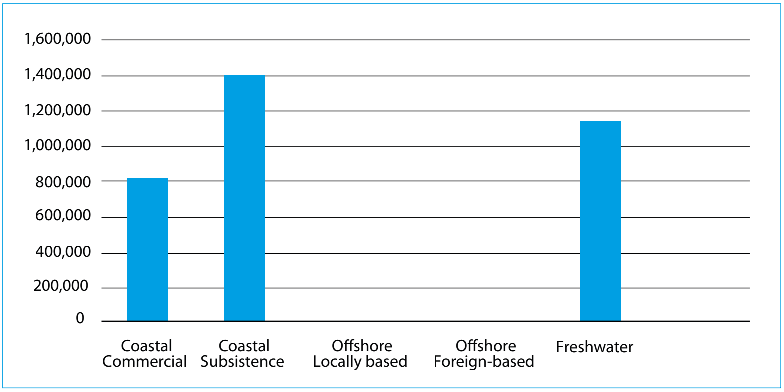


Figure 24-2: Northern Marianas Fisheries Production by Value (US$), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for CNMI from those studies are provided in Table 24-4.[4]

4 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 (mt, and pcs where indicated)	Nominal Value (US$)
Coastal Commercial	1999	n/a	n/a
	2007	231	950,000
	2014	142	821,356
Coastal Subsistence	1999	n/a	n/a
	2007	220	631,700
	2014	350	1,400,000
Offshore Locally based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Offshore Foreign-based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Freshwater	1999	n/a	n/a
	2007	0	0
	2014	0	0
Aquaculture	1999	n/a	n/a
	2007	14	205,000
	2014	41 mt and 15,000 pieces	1,130,000

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

The apparent changes in production for the three-year period represents a real change in production in some cases, but this can also represent a change in the methodology for measuring the 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. Some of that change is due to the way in which the production was estimated – In the present study additional analysis was available from the Cuetos-Bueno and Houk (2014) study. In contrast, changes in production figures in the table for aquaculture (based on the availability of better quality data) are likely to reflect real changes in the amounts being harvested.

24.2 Contribution of Fishing to GDP

Current Official Contribution

The Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce has made estimates of the GDP of the Northern Marianas, 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$665 million in 2012, and US$682 million in 2013 (BEA 2014).

Method Used to Calculate the Official Fishing Contribution to GDP

Officials of Central Statistics, in CNMI's Department of Commerce, are not certain that the BEA GDP estimate for the Northern Marianas considers the fishing sector (J. Andrew, per. com. September 2015).

Estimate of Fishing Contribution to GDP

Table 24-4, below, represents one option for estimating fishing contribution to the GDP of the Northern Marianas. 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 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 24-4: Fishing Contribution to CNMI GDP in 2014

Harvest Sector	Gross Value of Production (US$, from Table 24-3)	VAR	Value Added (US$)
Coastal Commercial	821,356	0.60	492,814
Coastal Subsistence	1,400,000	0.80	1,120,000
Offshore Locally based	0	0	0
Freshwater	0	0	0
Aquaculture	1,130,000	0.45	508,500
Total	**3,351,356**	---	**2,121,314**

The contribution of fishing to GDP in 2014, estimated in the above table (US$2.1 million), represents about 0.3% of the US$682 million GDP estimate for CNMI for 2013.

24.3 Exports of Fishery Production

The Bureau of Economic Analysis of the U.S. Department of Commerce has made estimates of the exports of the Northern Marianas. BEA (2014) indicates that the total exports of CNMI were US$15 million in 2012 and US$16 million in 2013. Information is not readily available for fishery exports.

It is often assumed that there are no finfish exports for CNMI (e.g. Rhodes et al. 2011). The aquaculture section of this chapter states that two aquaculture products are exported:

- The shrimp *Litopenaus vannamei* for Saipan and Guam markets: 2014 production was about 25 tons,[5] valued at US$9 per pound.
- *Litopenaeus* broodstock for export: 2014 production was about 15,000 pieces, valued at US$40 per piece.

For the purpose of the present study it is assumed (with limited evidential basis) that one-quarter of the market shrimp and all of the broodstock are exported. This equates to exports of about US$712,500 in 2014, which represents about 4.5% of all exports in 2013.

The large tourism industry generates substantial imports of seafood. In addition to canned fish, CNMI imports fresh fish from Palau, FSM and Marshall Islands. VanBeukering (2006) notes rapidly increasing reef fish imports into Saipan, particularly after 1998.

24.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

There is currently no authorised foreign fishing in the CNMI zone, and no access fees are received. United States vessels are considered to be domestic vessels.

5 This is assumed to be a "short ton" (i.e. 2,000 pounds).

Other Government Revenue from Fisheries

There are no requirements for commercial fishing vessels, operators or crew licenses for inshore or offshore waters of CNMI. (Allen and Amesbury 2012).

24.5 Fisheries-Related Employment

Various studies of CNMI fisheries contain information on aspects of 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. some of the fishing operations are market owned, while others remain independent. Most professional operations will travel as far as Rota (70–120 km), but typically fish in Saipan, Aguijan or Tinian. The remaining contributions of marketed landings come from "semi-subsistence" CNMI fishermen that sell a portion of their catch to generate additional income. These operations are usually land based (i.e., no boat is used), and typically operate at night. More than 50 professional fishers are estimated to work for formal businesses, while the number of independent and semi-subsistence fishers is unknown.

VanBeukering (2006) states 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). An additional 30% stated that compensation varied from trip to trip. The survey asked: "How would you define yourself as a fisherman? (check all that apply)". Table 24-4 categorises the responses.

Table 24-4: How CNMI Fishers Categorise Themselves

Full-Time Commercial	Part-Time Commercial	Cultural	Subsistence
15.2%	17.9%	29.5%	46.4
Recreational Expense	Purely Recreational	Multiple Motivations	
30.3	17.9	36.6	

The CNMI Prevailing Wage and Workforce Assessment Study (Central Statistics 2015) indicates that, of the 24,658 people employed in 2014, 425 were employed in "farming fishing and forestry". No further disaggregation is provided.

24.6 Levels of Fishery Resource Consumption

The readily available studies that provide information on CNMI fish consumption are summarised below:

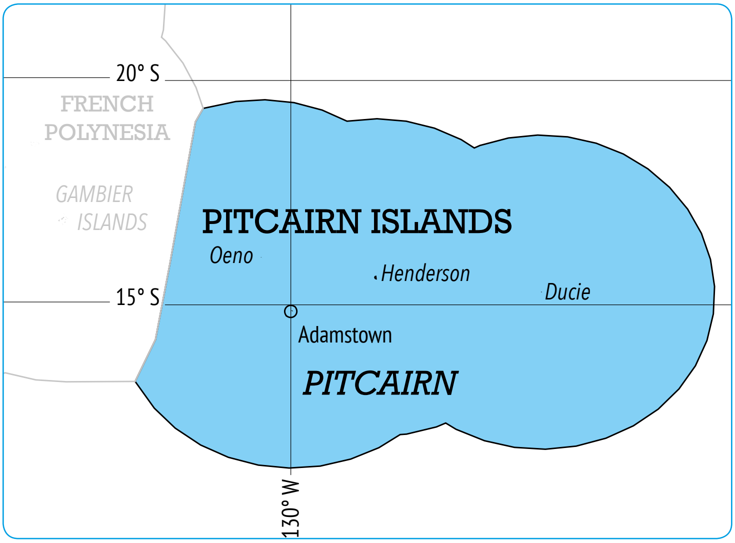
- Gillett and Preston (1997) estimated that production from coastal fisheries (commercial and subsistence) in CNMI in the early 1990s equated to an annual per capita fish supply of 66.5 kg. This figure was partially based on the Dalzell et al. (2006) production estimate of 2,825 mt annually from CNMI's 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 (2009) states that unpublished data from the 2005 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 report 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. (2009) cover per capita fish consumption across the Pacific Islands 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.

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

Dalzell et al. (1996) indicated that Pitcairn's annual commercial fisheries production was zero in the early 1990s. Gillett (2009) 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, on Pitcairn, there was an annual coastal commercial catch in the mid-2000s of 5 mt, worth NZ$51,000, and a coastal subsistence catch of 7 mt, worth NZ$50,000.

A description of coastal commercial fishing and the sale/bartering of fish is provided in Box 25-1.

Box 25-1: Coastal Fishing on Pitcairn Island

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 many types of fisheries information. Subsequent to the visit SPC carried out some 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 follows:

- In 2014 the resident population of Pitcairn consisted of 42 locals and 7 expatriates. (M. Christian, per. com. January 2016)
- In late 2011 there were 10 privately owned wooden fishing boats and two long boats used for transshipment of cargo and passengers. (M. Blanc, per. com. August 2015)
- There are no full-time fishers, but there are eight part-time commercial fishers (seven men and one woman). (Blanc 2011, citing S. Christian)
- In addition to the eight commercial fishers, there are about 15 non-commercial fishers. (Sharp 2011)
- Possibly one-third of the catch of the eight commercial fishers is personally consumed, one-third is traded, and one-third is given away. (Blanc 2011, citing S. Christian)
- A study of social welfare on Pitcairn (Weil and Gardener 2013) indicated that household earnings from fishing were NZ$1,000 annually for the 23 households on the island.
- In an economic analysis of the proposed Pitcairn marine reserve (Dickie et al. 2012) it is stated that fishing is an important source of income and food for Pitcairn Islanders. Nanwi (Grey Sea Chub), red snapper (black tip grouper), fafaya (lunar-tail grouper), tunny (yellowfin tuna), and wahoo are the main species caught by Pitcairn Islanders. The catch

of fish is currently divided into three parts: personal consumption (by the fisher), trading and free distribution (to other islanders). Catches are sold on Pitcairn Island for approximately NZ$2 per kg.

- The occasional on-island sale of fish (NZ$2/kg) is predominantly for cat food at times when catches are abundant; e.g. during the wahoo season. (Blanc 2011)

Selectively using the above information (and placing high credibility on the SPC work), the 2014 coastal commercial catch is judged to be 9 mt, comprising 3 mt of coastal commercial (worth NZ$18,000 to fishers) and 6 mt of coastal subsistence (worth NZ$12,000 to fishers).

Coastal Subsistence Catches

Dalzell et al. (1996) indicate that Pitcairn's annual subsistence fisheries production was 8 mt in the early 1990s. Gillett (2009) estimated a coastal subsistence catch of 7 mt, worth NZ$50,000. He based the value on the price for fish sales to visiting vessels, discounted by 30%.

Following the logic in the above section on coastal commercial fisheries, it is judged that the 2014 Pitcairn Island coastal subsistence catch was 6 mt. Valuing that catch according to the price of the limited amount of domestic fish sales on the island (NZ$2/kg), it was worth NZ$12,000 to fishers.

Locally Based Offshore Catches

There is no locally based offshore fishing in Pitcairn.

Foreign-Based Offshore Catches

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 (Adams and Langley 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, more recently, 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.

An important issue for future offshore fishing in the Pitcairn zone is the establishment of a large marine protected area. A Pitcairn Island economic review (Solomon and Burnett 2014) states that, in 2011, the Pitcairn Island Council voted in favour of investigating the possibility of creating a Marine Reserve within Pitcairn waters. The purpose of the proposed Pitcairn Islands Marine Reserve is to fully protect the special marine environment and to provide a world-class, fully protected marine reserve to attract scientific research, non-consumptive tourism and other non-extractive economic uses, as well as favourable global recognition for Pitcairn. The Marine Reserve proposal allows for the zone between Pitcairn Island's mean low water, and extending to 12 nautical miles offshore, to be excluded from the marine reserve, to allow Pitcairn Islanders to continue to use the area around the island for fishing and other activities in the same way as they do now.

According to an Auckland-based official of the Pitcairn Islands Office, the Pitcairn Islands Marine Reserve has been ratified by the British government (E. Dunn, per. com. January 2016). According to the Pitcairn-based Environmental, Conservation and Natural Resources Division Manager of the Government of Pitcairn Islands, Pitcairn will receive the official notification of the establishment of the marine reserve in late 2016.

Freshwater Catches

There are no freshwater fisheries in Pitcairn.

Aquaculture Harvests

There are no aquaculture activities in Pitcairn.

Summary of Harvests

A crude approximation of the annual volumes and values of the fishery harvests in 2014 can be made from the above sections (Table 25-1).

Table 25-1: Annual Fisheries and Aquaculture Harvest in Pitcairn, 2014

Harvest Sector	Volume (mt)	Value (NZ$)
Coastal Commercial	3	18,000
Coastal Subsistence	6	12,000
Offshore Locally based	0	0
Offshore Foreign-based	0	0
Freshwater	0	0
Aquaculture	0	0
Total	**9**	**30,000**

Figures 25-1 and 25-2 show the volumes and values of the 2014 Pitcairn fisheries production.

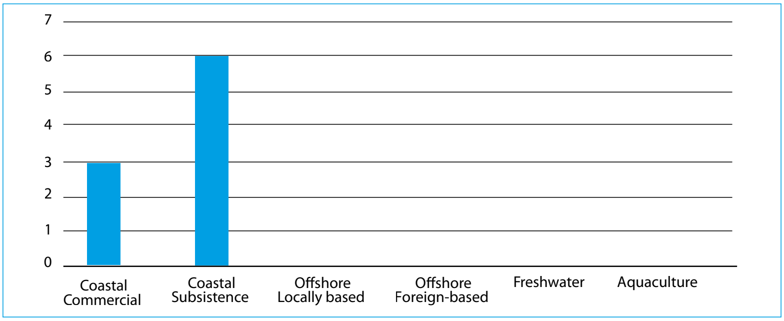


Figure 25-1: Pitcairn Fisheries Production by Volume (mt), 2014

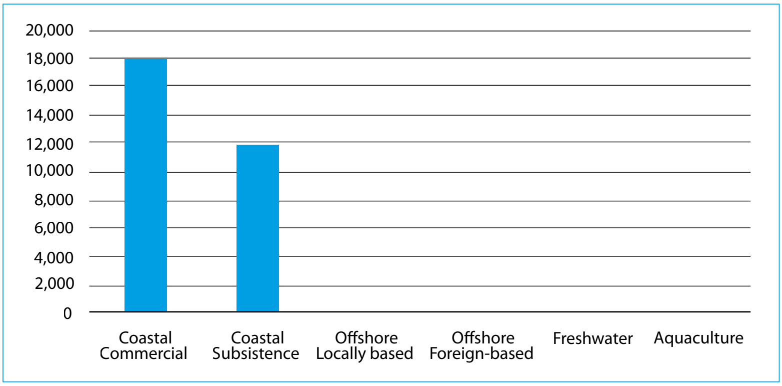


Figure 25-2: Pitcairn Fisheries Production by Value (NZ$), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. 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 two studies that included Pitcairn.

Table 25-2: The Results of the Benefish Studies for Pitcairn

Harvest Sector	Volume (mt)	Value (NZ$)
Coastal Commercial 2007	5	51,000
Coastal Commercial 2014	3	18,000
Coastal Subsistence 2007	7	50,000
Coastal Subsistence 2014	6	12,000

From the above table it can be seen the volumes of production are fairly similar between the years, with the 2014 amount probably being more accurate due to 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 the 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 2014

Harvest Sector	Gross Value of Production (NZ$, from Table 25-1)	VAR	Value Added (NZ$)
Coastal Commercial	18,000	0.65	11,700
Coastal Subsistence	12,000	0.95	11,400
Offshore Locally based	0	0	0
Freshwater	0	0	0
Aquaculture	0	0	0
Total			**23,100**

25.3 Exports of Fishery Production

The only exports of fishery products from Pitcairn is the catch that is sold to visiting vessels (cruise ships, merchant ship, yachts and fishing vessels).

An SPC study (Sharp 2011) provides information on that 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 150kg of fish and 100kg 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 $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.

The major exports of Pitcairn are fruits, vegetables, curios and stamps.[1] The total value of all exports from Pitcairn is not readily available.

1 http://www.theodora.com/wfbcurrent/pitcairn_islands/pitcairn_islands_economy.htm

25.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

There is no authorised foreign fishing in the Pitcairn zone.

The last time access fees were paid for fishing in the Pitcairn zone was in December 2006 (E. Dunn, per. com. January 2016). At that time a single, one-off licensing agreement was made with a Spanish-registered longliner by the Commissioner for the Pitcairn Islands, for a flat fee of US$1,000 (Irving and Dawson 2012).

Other Government Revenue from Fisheries

No information is available on other forms of government revenue from the fisheries sector.

25.5 Fisheries-Related Employment

Sharples (1994) provides a detailed account of the involvement of Pitcairn Islanders with fishing:

- There are eight or nine "hard-core fishers" on the island, with another three or four who also fish fairly regularly. Ron, Charles, Randy, Steve, Len, Dave, Claris, Paul and Terry are considered hard-core fishers, with Jay, Brian, Olive and Merelda being regulars.
- On any fine day that is not booked out for some public duty or communal task or activity, at least six and often up to nine skiffs are out fishing most with one fisher but a couple with two aboard.
- Women and men fish regularly from the rocks, mainly for a fish locally called nanwi, for the evening meal.
- If a large vessel is expected (in particular a cruise vessel) then fishing effort increases and the hard-core could be out fishing from dawn to dusk

Some more recent summary information is available on participation in fisheries on Pitcairn, as follows:

- There are no full-time fishers, but there are eight part-time commercial fishers: seven men and one woman (Blanc 2011, citing S. Christian).

- In addition to the eight commercial fishers, there are about 15 non-commercial fishers (Sharp 2011).
- A study of social welfare on Pitcairn (Weil and Gardener 2013) indicated that total household earnings from fishing in 2012 were NZ$1,000 (across the 23 households on the island).

25.6 Levels of Fishery Resource Consumption

Gillett and Preston (1997) estimated 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.

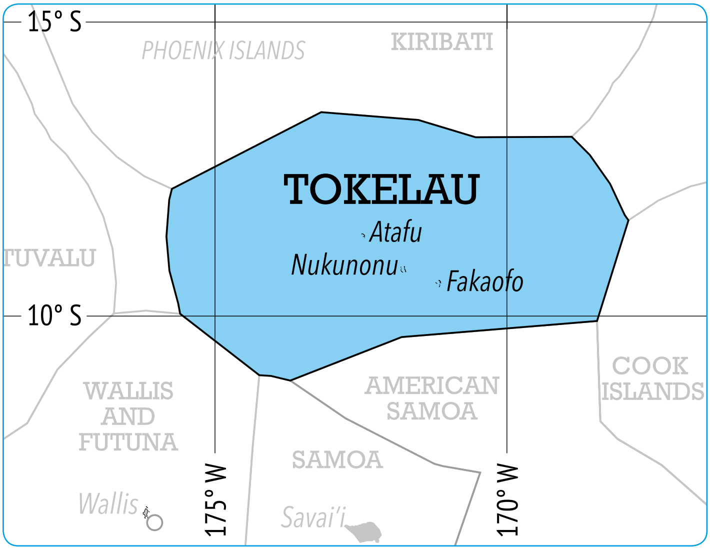
The present study estimates 2014 coastal commercial fisheries production of 3 mt, and coastal subsistence production of 6 mt. If it is assumed that all of the subsistence production and 1.5 mt of the coastal commercial production is eaten by the humans of Pitcairn (i.e. not used as cat food or sold to visiting vessels), then average annual per capita consumption is about 153 kg for the 49 residents.

25.7 Exchange Rates

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

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.51	1.42	1.54	1.36	1.32	1.39	1.30	1.29	1.21	1.22	1.28

26 Tokelau



26.1 Volumes and Values of Fish Harvests in Tokelau

Coastal Commercial Catches in Tokelau

Gillett (2009) considered the available documentation on coastal fisheries in Tokelau, and stated the following:

> Dalzell et al. (1996) indicates 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". Passfield (1998) indicates there is 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." In view of this information, all coastal fishing in Tokelau is considered to be subsistence fishing and for the purpose of the present study, the commercial production is deemed to be zero.

The 2011 Tokelau census report (Statistics New Zealand 2012) contains additional information relevant to coastal commercial fisheries. It indicates the percentage of households on each island that receive income from various sources, including from the sale of fish. 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. It can therefore be concluded that there is at least some coastal commercial fishing in Tokelau.

Past estimates of coastal fisheries production in Tokelau (mainly subsistence, but including any commercial) have mainly been focussed on Fakaofo. Those Fakaofo studies were cited in the Gillett (2009) study, and an attempt was made to extrapolate the results to all of Tokelau:

- Gulbrandsen (1977) estimated that an annual total of 28 mt of fish was required to satisfy the nutritional requirements of the 665 residents of Fakaofo. (84 mt 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 mt. (234 mt 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 mt of fish was landed. (299 mt for all of Tokelau)
- Passfield (1998) spent 21 days on Fakaofo in July and August 1998, and estimated a total annual Fakaofo fishery production of 150 mt, and 450 mt for all of Tokelau.

The Gillett (2009) study considered the above studies, but discounted the results of the Passfield study.[1] Gillett (2009) estimated that the 2007 coastal fishery production in Tokelau (assumed to be all subsistence) was 375 mt, worth NZ$967,500.

1 Passfield's annual production estimate for 1998 of 450 mt, together with the probable level of recent exports and the recent decrease in Tokelau's population, resulted in a per capita consumption for 2007 that appeared improbably large.

The Director of Tokelau's Department of Economic Development, Natural Resources and Environment provided information on events in recent years that may have affected the production of coastal fisheries (M. Perez, per. com. September 2015). He stated the following:

- In the last decade there have been no major shocks or disasters (e.g. cyclones, wave action) that have affected fishing activity.
- In the last 10 years the amount of fish exported from Tokelau has increased, perhaps a doubling of the quantity during the decade.
- In 2014 there was a large increase in overseas visitors to Tokelau, due to the anniversary celebrations of the Catholic Church and FFA meetings.
- The ship servicing Tokelau has greater capacity than in the past.
- Recently the average price paid to a fisher for a 1.5 kg skipjack was NZ$5.

There have been some sales of beche de mer. Pasilio et al. (2013) stated that, in 2012, village fishers began harvesting in early 2012, selling their catch fresh in 18- or 20-litre buckets, for NZ$15 to NZ$20 per bucket of fresh, un-gutted sea cucumber.

Other information that is relevant to making an estimate of coastal commercial fishing in Tokelau is detailed below:

- The Tokelau paper for the 2015 meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission (Anon. 2015) states that Tokelau has "quite a large artisanal fleet of about 30-40 small 12' to 16' open aluminium dinghies powered by 15-30HP outboards".
- The preliminary results from the SPC-assisted monitoring of pelagic fishing by those small boats indicate an annual catch of about 98 mt. (D. Brogan, per. com. August 2015)
- The population of Tokelau decreased by 0.3% between 2007 (the focal year of the Gillett [2009] study) and 2014 (the focal year of the present study [SPC PRISM website information]). In absolute terms, this was a decrease of three people, from 1,169 to 1,166.
- In 2014 there were 47 ship departures from Apia to Tokelau. (Jasperse 2015)
- An analysis of goods shipped in 2014 from Tokelau to Samoa shows 62,867 kg of frozen seafood. (Tokelau administration, unpublished data)

The above information is inadequate for updating the coastal fisheries production of Tokelau. Nevertheless, if the 2007 estimate of 375 mt is expanded to account for increasing exports in recent years and a large visitor presence in Tokelau in 2014, the coastal fisheries production in that year could be around 400 mt. 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 mt). At a semi-arbitrary price to fishers of NZ$3.50 per kg (based on general market knowledge), the value of the annual commercial catch equates to NZ$140,000.

Coastal Subsistence Catches

Following the above logic, the coastal subsistence catch in 2014 is taken to be 360 mt. Valuing that subsistence catch by the farm gate method (discounting by 30% to allow for marketing) the subsistence catch would be worth NZ$882,000 to fishers.

Locally Based Offshore Catches

There is no locally based offshore fishing in Tokelau.

Foreign-Based Offshore Catches

The Tokelau paper for the 2015 meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission (Anon. 2015) states that, in 2014, "excluding the US treaty vessels, a total of 26 purse seine vessels were licensed by Tokelau: 11 flagged by Korea, 2 flagged by Kiribati, 4 flagged by Spain, 3 flagged by Ecuador, 2 flagged by El Salvador and 4 flagged by NZ. The majority of effort that occurred in Tokelau's EEZ for 2014 were carried out by purse seine and a majority of this effort occurred in the north and north eastern parts of the Tokelau zone. Only 3 LL vessels, flagged to Kiribati, were licensed by Tokelau in 2014."

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries Commission have been made by the Forum Fisheries Agency using data sourced from the Oceanic Fisheries Programme of the Pacific Community. The volumes and values can be determined using FFA (2015). Table 26-1, below, takes those volumes and (for longlining) adjusts them for bycatch. The values in the table are adjusted to account for: (a) the value of the longline bycatch, and (b) the cost of the transport of the purse seine and longline catches (i.e. the FFA overseas market prices, less transport charges to those markets).

Table 26-1: The Volume and Value of the Foreign-Based Offshore Catches

	2010	2011	2012	2013	2014
Volume purse seine tuna catch (mt)	3,758	19,559	20,539	15,856	23,748
Volume longlinetuna catch (mt)	0	436	337	0	413
Nominal value purse seine tuna catch (US$)	4,791,496	33,328,535	44,064,937	33,121,129	35,123,723
Nominal value longline tuna catch (US$)	0	3,810,188	2,692,232	0	2,838,431
Total volume purse seine and longline catch (longline adjusted for bycatch) (mt)	3,758	20,125	20,977	15,856	24,286
Total value purse seine catch (adjusted for cost of transport) and longline catch (adjusted for cost of transport and value of bycatch) (US$)	4,120,686	32,603,396	40,689,252	28,484,171	33,168,859

Source: FFA (2015)

The 2014 foreign-based offshore catch was 24,286 mt, with an in-zone value of US$33.2 million (NZ$42.5 million).

2014 does not appear to have been a typical year for foreign-based offshore fishing in the Tokelau zone – it was an annual record high. The annual average over the 10-year period 2005–2014 was 10,319 mt. 2014 was a strong El Niño year, and purse seine catches characteristically move eastwards from PNG and FSM towards Kiribati, Tuvalu and Tokelau during El Niño periods.

Freshwater Catches

There are no freshwater fisheries in Tokelau.

Aquaculture Harvests

There are no aquaculture activities in Tokelau.

Summary of Harvests

A crude approximation of the annual volumes and values of the fishery and aquaculture harvests in 2014 can be made from the above sections (Table 26-2).

Table 26-2: Annual Fisheries and Aquaculture Harvest in Tokelau, 2014

Harvest Sector	Volume (mt)	Value (NZ$)
Coastal Commercial	40	140,000
Coastal Subsistence	360	882,000
Offshore Locally based	0	0
Offshore Foreign-based	24,286	42,500,000
Freshwater	0	0
Aquaculture	0	0
Total	**24,686**	**43,522,000**

Figures 26-1 and 26-2 show the volumes and values of the 2014 Tokelau fisheries production.

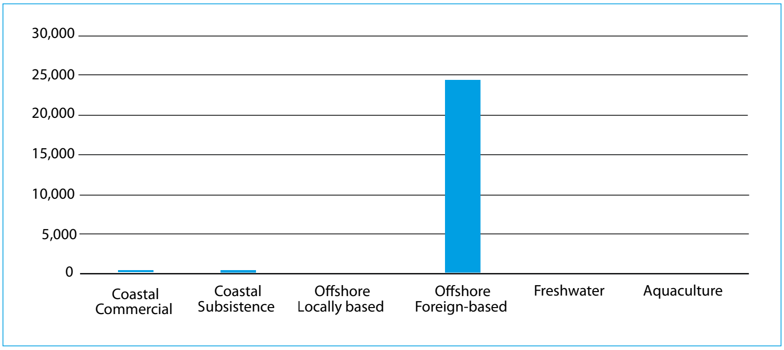


Figure 26-1: Tokelau Fisheries Production by Volume (mt), 2014

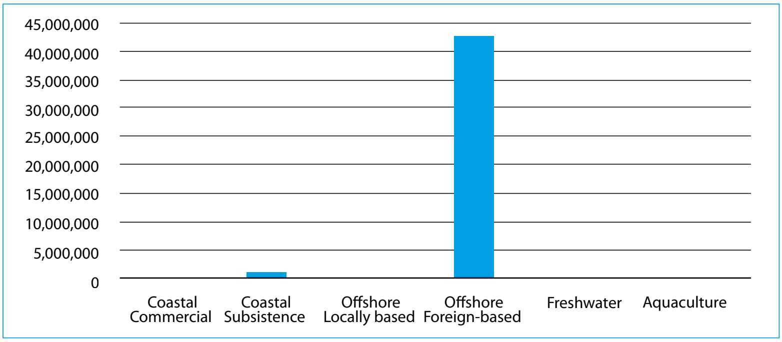


Figure 26-2: Tokelau Fisheries Production by Value (NZ$), 2014

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for Tokelau from those studies are provided in Table 26-3.[2]

Table 26-3: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Estimate Year	Volume (mt, and pcs where indicated)	Nominal Value (NZ$)
Coastal Commercial	1999	n/a	n/a
	2007	0	0
	2014	40	140,000
Coastal Subsistence	1999	n/a	n/a
	2007	375	967,500
	2014	360	882,000
Offshore Locally based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Offshore Foreign-based	1999	n/a	n/a
	2007	318	540,484
	2014	24,286	42,500,000
Freshwater	1999	n/a	n/a
	2007	0`	0
	2014	0	0
Aquaculture	1999	n/a	n/a
	2007	0	0
	2014	0	0

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

The apparent changes in production for the three years sometimes represents a real change in production, but it can also reflect a change in the methodology for how the production is measured (hopefully an improvement), or new data becoming available. In the table above, the production levels for coastal commercial and coastal subsistence change significantly between the years, but

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

some of that change is due to new information. For example, the 2011 Tokelau census report (Statistics New Zealand 2012) showed that coastal commercial fishing does indeed exist in Tokelau. In contrast, changes in production figures in the table for the offshore fisheries (based on the availability of better quality data) are likely to reflect real changes in the amounts being harvested.

26.2 Contribution of Fishing to GDP

Current Official Contribution

Official GDP estimates are not produced for Tokelau.

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 26-4, below, represents one option for estimating fishing contribution to the GDP of Tokelau. 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 26.1, above (summarised in Table 26-2), 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).

Table 26-4: Fishing Contribution to Tokelau GDP in 2014

Harvest Sector	Gross Value of Production (NZ$, from Table 26-2)	VAR	Value Added (NZ$)
Coastal Commercial	140,000	0.75	105,000
Coastal Subsistence	882,000	0.95	837,900
Offshore Locally based	0	0	0
Freshwater	0	0	0
Aquaculture	0	0	0
Total	**1,022,000**	---	**942,900**

26.3 Exports of Fishery Production

An analysis of goods shipped in 2014 from Tokelau to Samoa shows 62,867 kg of "frozen seafood". (Tokelau administration, unpublished data) The value of exports from Tokelau are not declared. Taking the average price of fish in Tokelau from above (NZ$3.50 per kg), the 62.9 mt of "frozen seafood" exported from Tokelau is estimated to be worth about NZ$220,000. These volumes and values of exports do not include any dried fishery products.

Further relevant information on fishery exports from Tokelau is summarised below:

- There have been at least some exports of beche de mer from Tokelau. Pasilio et al. (2013) stated that, in 2012, village fishers began harvesting in early 2012, and selling their catch of fresh un-gutted sea cucumber. It is not known if the beche de mer trade continued beyond 2012.
- Atafu has problems with ciguatera fish poisoning, so residents from that island export mainly tuna and flyingfish. Atafu and Fakaofo export all fish species. (M. Perez, per. com. September 2015)
- The amount of fish exported from Tokelau has increased in the last 10 years, representing perhaps a doubling of the quantity over the decade. (M. Perez, per. com. September 2015).

26.4 Government Revenue from Fisheries

Access Fees for Foreign Fishing

As stated above, the Tokelau paper for the 2015 meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission (Anon. 2015) states that, in 2014:

> excluding the US treaty vessels, a total of 26 purse seine vessels were licensed by Tokelau: 11 flagged by Korea, 2 flagged by Kiribati, 4 flagged by Spain, 3 flagged by Ecuador, 2 flagged by El Salvador and 4 flagged by NZ. The majority of effort that occurred in Tokelau's EEZ for 2014 were carried out by purse seine and a majority of this effort occurred in the north and north eastern parts of the Tokelau zone. Only 3 LL vessels, flagged to Kiribati, were licensed by Tokelau in 2014.

Tokelau receives access fees for the foreign fishing in its zone. From 2000 to 2010 access fees averaged slightly less than US$1 million per year. The access fees increased considerably after 2011, when Tokelau adopted a fisheries policy. The fees were US$1.25 million in 2011, US$3.1 million in 2102, US$6.4 million in 2013, US$9.05 million in 2014, and US$10.4 million in 2015. (S. Crothers, per. com. January 2016)

If total revenue of the Tokelau government for the financial year 2014/15 was NZ$22 million[3], the access fees in 2014 of US$9.05 million (NZ$11.6 million) represented about 52.6% of the government revenue.

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).

26.5 Fisheries-Related Employment

The 2011 census contains employment information. Unfortunately, the report of the census (Statistics New Zealand 2012) only disaggregates the 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.

There is some information in the census on participation in fishing. The data show that males were much more likely than females to help with village fishing (68.4 percent of males, compared with 6.7 percent of females). Tokelau residents in the age category of 50 to 59 years had the highest proportion of people who helped with village fishing (44.8 percent).

An SPC/FFA mission to Tokelau was carried out in August and September 2003. The main aims of the mission were to gather information for drafting a national tuna fishery development and management plan, and to collect gender-disaggregated data on Tokelau fishing activities. (Chapman et al. 2005). Information from the mission on household participation in fishing is given in Table 26-5.

3 Definitive government revenue figures were not available.

Table 26-5: Tokelau Household Participation in Fishing

Atoll	No. of h/holds surveyed	No. people covered	People per h/hold	H/holds that fish	% h/holds that fish
Atafu	46	299	6.5	46	100.00
Fakaofo	58	320	5.5	57	98.30
Nukunonu	49	280	5.7	49	100.00
Total	**153**	**899**	**5.9**	**152**	**99.30**

Source: Chapman et al. (2003)

Other important points relevant to fisheries-related employment that emerged from the survey are summarised below:

- The almost 100% participation in fishing indicated in the table is even more remarkable, considering the one non-fishing household consisted entirely of a retired widow. This highlights the dependence of Tokelauans on harvesting marine products.
- Fathers, sons and other males were the main household members involved in fishing activities at all three atolls, whether fishing inside or outside the reef.
- For fishing outside the reef (trolling, mid-water fishing, flyingfish fishing and bottomfishing), mothers, daughters and other females made up only a very small percentage of the fishing effort at Atafu, and an even smaller percentage at Fakaofo. Women at Nukunonu were not involved in fishing outside the reef at all.
- Mothers, daughters and other females were involved in some inshore fishing methods, although males still dominated. Females accounted for just over 50% of the reef gleaning effort, and around 40% of diving effort, with most of the diving effort directed at harvesting clams.

26.6 Levels of Fishery Resource Consumption

Gillett and Preston (1997) estimated that the production from coastal fisheries in Tokelau in the early 1990s equated to an annual per capita fish supply of 119.4 kg.

Passfield (1998) indicated that the population of Fakaofo consumes an estimated average of 380 g of seafood per person. This equates to a total subsistence consumption of around 140 tons per year (or 248 kg per capita per year, whole fish equivalent). The report states that seafood is eaten, on average, for 12.6 meals per week, or at 73% of all meals consisting of some animal protein content. Fresh frozen meat or chicken, tinned meat and tinned fish are consumed in 13%, 9% and 5% of the meals, respectively. Approximately four meals per week contain no animal protein, and these are usually breakfasts, when rice or biscuits are eaten.

Tokelau's 2014 coastal fishery production is estimated by the present study to be 400 mt. "Frozen seafood" exports are shown in a section above to have been about 63 mt in 2014, some of which would be semi-processed (e.g. headed/gutted). During that year the population of Tokelau was 1,166 people. If it is assume that the whole fish equivalent of the "frozen seafood" exports was 75 mt, this equates 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 Tuvalu and Kiribati, due to the relative affluence of Tokelau and its strong bonds to New Zealand, facilitating the purchase of imported protein products. This is shown 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.

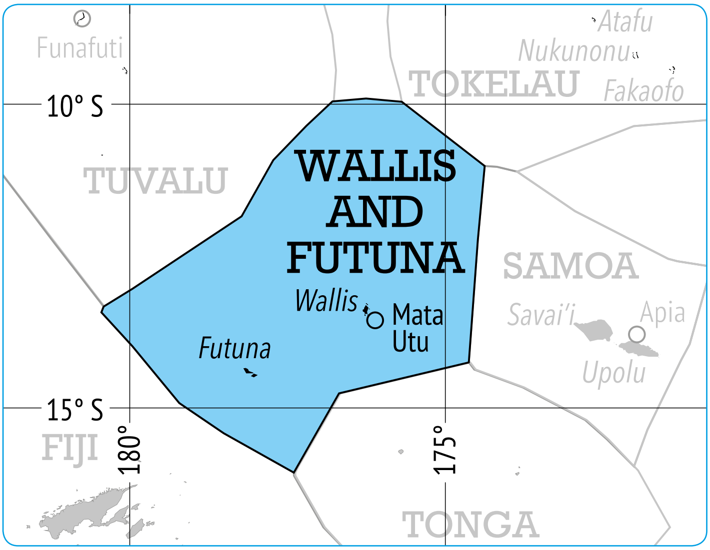
The imports above equate to 99.4 kg/person/year, and this high rate would tend to lower the consumption of fish to some degree.

26.7 Exchange Rates

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

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.42	1.54	1.36	1.32	1.39	1.30	1.29	1.21	1.22	1.28

27 Wallis and Futuna[1]



27.1 Volumes and Values of Fish Harvests in Wallis and Futuna

Coastal Commercial Catches in Wallis and Futuna

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 mt (worth US$2,316,729) and a coastal subsistence production of 621 mt (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.

1 The French version of this chapter appears in Appendix 6, page 615 / *La version française de ce chapitre se trouve page 615 (Appendix 6).*

- Gillett (2009) considered several types of information related to coastal fisheries in Wallis and Futuna, including the Dalzell et al. (1996) estimate, 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 mt, which was worth XPF (Pacific Franc Exchange) 105 million.

In 2014 an agriculture survey was carried out in Wallis and Futuna (Sourd and Mailagi 2015). Although that work focused on agriculture, it also contained some fisheries information. The results that have some bearing on annual fish catches include the following:

- In comparing the results to an earlier survey, 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.
- Of the 658 interviewed households that are involved with fishing, 179 fish from boats they own, 99 fish from boats they do not own, and 380 fish without a boat.
- Of the 658 interviewed households that are involved with fishing, the primary catches are lagoon fish (361 households), pelagic fish (241), crustaceans (30), and other shellfish (26).
- Of the fishing households that sell fish, 59% sell their catch for an average price of between 900 and 1,000 XPF per kg. 32% sell for less than this amount and 9% sell for more.
- Table 27-1 gives information on the disposal of the catch.

Table 27-1: Disposal of the Catch by Fishing Method

Type of fishing	Number households doing this fishing	Traditionnal exchange		Own household		Sale	
		Yes	No	Yes	No	Yes	No
Trolling	140	67	73	137	3	68	72
Deep slope fishing	49	29	20	47	2	32	17
Handline fishing	169	81	88	169	-	57	112
Net fishing	327	119	208	321	6	76	251
Spearfishing	287	112	175	281	6	114	173
Shell collecting	129	43	86	128	1	36	93
Lobster/crab diving	104	39	65	102	2	43	61
Other kinds of fishing	74	21	53	72	2	8	66

Source : Sourd et Mailagi (2015)

An official of the Bureau de la pêche et de l'aquaculture (B. Mugneret, per. com. November 2015) indicated the following:

- Although Cyclone Evan in late 2012 resulted in considerable destruction of crops, few boats were damaged. As a result, there was a subsequent increase in fisheries production to maintain food supplies.
- The number of operational fish aggregation devices (about 3 or 4 in the territory) has remained relatively constant over the last decade.
- There was a spurt of commercial fishing in 2013 before and during the Pacific Island Mini-Games.
- There were no exports of trochus or beche-de-mer in 2014. The only substantial fisheries export in that year was shell necklaces.

The following information may be relevant for estimating coastal fishing production:

- The population of Wallis and Futuna decreased by 14.9% between 2007 and 2014 (the focus years of the Gillett (2009) survey and the present study, respectively). (SPC PRISM website data).
- Kronen et al. (2008) cite various authors who have commented on overfishing in the Wallis lagoon, from the early 1930s. Overfishing in the past has mainly been attributed to the use of destructive fishing methods (especially explosives and a range of poisons) and the use of small-mesh gillnets.
- Bell at al. (2008), using household survey information, estimate that 86% of the coastal fisheries production of Wallis and Futuna is for subsistence purposes, and 14% is for sale. The paper also indicates that the estimated annual fisheries production, based on coral reef area, is 150 mt.

Following from the above, it is assumed that, since the Gillett (2009) estimate, there has been a slight decrease in total production (as evidenced by the decrease in the number of boats, the decrease in the population, and some over-exploitation), as well as a slight increase in commercialisation due to the evolution of the economy. Coastal commercial fisheries production in 2014 is estimated to be 150 mt, worth XPF 150 million.

Coastal Subsistence Catches

Following the logic presented above, the 2014 Wallis and Futuna coastal subsistence catch is estimated to have been 675 mt. Using the farm gate method for valuing subsistence production, this production is worth XPF 641,250,000.

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 purpose of the present study. There is no locally based offshore fishing fleet in Wallis and Futuna.

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).

Freshwater Catches

There are no freshwater fisheries in Wallis and Futuna. Tilapia has been introduced into freshwater bodies on Wallis (Hinds 1969), but it is not considered a food fish.

Aquaculture Production

Although there have been some recent aquaculture trials on Wallis (e.g. Macrobrachium, Nandlal 2005), there is currently no aquaculture production in the territory.

Summary of Harvests

A crude approximation of the annual volumes and values of the fisheries and aquaculture production in Wallis and Futuna in 2014 is given in Table 27-2.

Table 27-2: Annual Fisheries and Aquaculture Harvest in Wallis and Futuna, 2014

Harvest Sector	Volume (mt)	Value (XPF)
Coastal Commercial	150	150,000,000
Coastal Subsistence	675	641,250,000
Offshore Locally based	0	0
Offshore Foreign-based	0	0
Freshwater	0	0
Aquaculture	0	0
Total	**825**	**791,250,000**

Figures 27-1 and 27-2 show the volumes and values of the 2014 Wallis and Futuna fisheries production. Aquaculture is not shown on the volumes figure, due to the use of mixed units (pieces and mt).

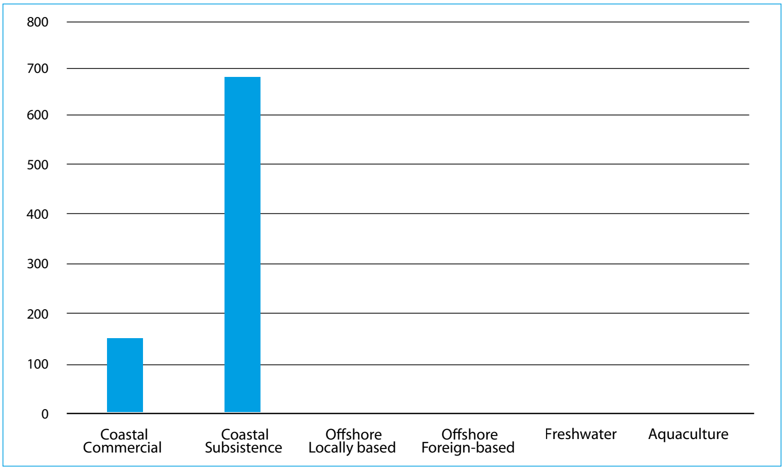


Figure 27-1: Wallis and Futuna Fisheries Production 2014 by Volume (mt)

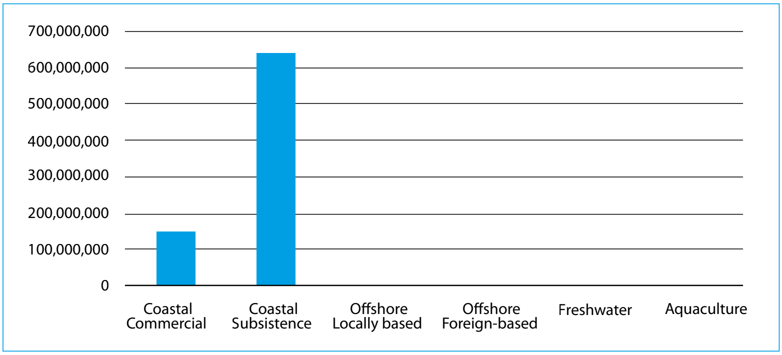


Figure 27-2: Wallis and Futuna Fisheries Production 2014 by Value (XPF)

Past Estimates of Fishery Production Levels by the Benefish Studies

Similar studies of the benefits to Pacific Island countries and territories from fisheries ("Benefish" studies) have been carried out in the past. Gillett and Lightfoot (2001) focused on 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The fishery production levels for Wallis and Futuna from those three studies are given in Table 27-3.[2]

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

Table 27-3: Estimates by the Benefish Studies of Annual Fisheries/Aquaculture Harvests

Harvest Sector	Year	Volume (tonnes et pièces)	Nominal Value (CFP)
Coastal Commercial	1999	n/a	n/a
	2007	121	105,000,000
	2014	150	150,000,000
Coastal Subsistence	1999	n/a	n/a
	2007	840	551,000,000
	2014	675	641,250,000
Offshore Locally based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Offshore Foreign-based	1999	n/a	n/a
	2007	0	0
	2014	0	0
Freshwater	1999	s/o	s/o
	2007	0	0
	2014	0	0
Aquaculture	1999	n/a	n/a
	2007	0	0
	2014	0	0

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

27.2 Contribution of Fishing to GDP

Current Official Contribution

2005 is the latest year for which the Wallis and Futuna GDP has been estimated. IEOM (2015) states that there is no entity in the territory with responsibility for GDP calculations. In 2008 the French CEROM programme evaluated the Wallis and Futuna economy using "rapid accounting techniques", and established a GDP of XPF 18 billion for 2005. This equates to a GDP per capita of XPF 1.2 million.

Method Used to Calculate the Official Fishing Contribution to GDP

Information about the method used to calculate the contribution of fishing to GDP is not readily available. Existing documentation and staff currently employed at the Wallis offices of the Institute d'Emission d'Outre-Mer and the Service Territorial de la Statistique are unaware of how the GDP estimate was made.

Estimate of Fishing Contribution to GDP

Table 27-4, 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 27-2), and determines the value added by using value added ratios that are characteristic for the type of fishing concerned. Those VARs were determined by knowledge of the fisheries sector and through the use of specialised studies (Appendix 3).

Table 27-4: Fishing Contribution to the Wallis and Futuna GDP in 2014

Harvest Sector	Gross Value of Production (XPF, from 27-3)	VAR	Value Added (XPF)
Coastal Commercial	150,000,000	0.65	97,500,000
Coastal Subsistence	641,250,000	0.80	513,000,000
Offshore Locally based	0	0	0
Freshwater	0	0	0
Aquaculture	0	0	0
Total (XPF)			**610,500,000**

It is not possible to determine the percentage of the GDP of Wallis and Futuna that this XPF 610.5 million represents – the above table is for 2014, while the latest year for which the GDP has been calculated is 2005. The Gillett (2009) study 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

In recent years trochus, beche-de-mer, and artisanal handicrafts have been the main exports of Wallis and Futuna. The available information shows:

- There were no exports of trochus or beche-de-mer in 2014. About 2.7 mt of beche-de-mer was exported in 2013 (B. Mugneret, per. com. November 2015).
- The only substantial fisheries export in 2014 appears to have been shell necklaces bought by departing passengers, with an estimated annual FOB value of XPF 10 million.
- IEOM (2015) indicates that the total value of all exports from Wallis and Futuna in 2014 was XPF 21.5 million, with marine products and handicrafts the only exports.
- The latest detailed exports statistics available from the Service Territorial de la Statistique are for the year 2011, when 1.078 mt of beche-de-mer (with a declared value of XPF 348,050) and 17 mt of trochus (with a declared value of XPF 5,100,00) were exported.

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.

Other Government Revenue from Fisheries

In Wallis and Futuna the fishing sector is not revenue generating, but rather is subsidy absorbing. Subsidies are available for the purchase of a fishing vessel (reported to be up to 60% of construction costs) and fuel for its operation (up to 60%). Sea safety equipment is tax free. (B. Mugneret, per. com. November 2015)

27.5 Fisheries-Related Employment

IEOM (2015) estimates that there are about 40 professional fishers in Wallis and Futuna (i.e. full-time commercial fishers), with around 20 boats, which are mostly between 6 and 10 metres in length. It is also estimated that one in three households engages in some kind of fishing.

A recent survey (Sourd and Mailagi 2015) studied participation in fishing. The results are presented in Table 27-5.

Table 27-5: Participation in Fishing in Wallis and Futuna

Geographic area of residence	Participate in fishing?		Percentage participation
	Yes	No	
Alo	170	237	41,8 %
Sigave	93	169	35,5 %
Total Futuna	**263**	**406**	**39,3 %**
Hahake	82	429	16,0 %
Hihifo	126	190	39,9 %
Mua	187	369	33,6 %
Total Wallis	**395**	**988**	**28,6 %**
Total Wallis and Futuna	**658**	**1 394**	**32,1 %**

Source : Sourd et Mailagi (2015)

SPC (1999) discusses the different gender roles in fishing on Wallis and on Futuna. On Futuna men do fish, however women provide most of the daily seafood. The island of Wallis is relatively flat compared to Futuna, and gardens do not have to be made in difficult terrain so far away from the villages, hence garden work is not as demanding on Wallis and so women do much of that work. Accordingly, the women of Wallis are not involved in fishing to the same extent as Futunan women are.

SPC (2013) indicates that, across Wallis and Futuna, just over half of all fishers are men.

27.6 Levels of Fishery Resource Consumption

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. (2009) use information from household income and expenditure surveys conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both subsistence and cash acquisitions. The HIES 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.

The present study estimates the 2014 coastal fisheries production (subsistence and commercial) to be 825 mt. This equates to 68.7 kg of fish per capita across the Wallis and Futuna population of 12,011 (SPC PRISM website data). This figure does not consider imports of fishery products.

27.7 Exchange Rates

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

2000	2001	2002	2003	2004	2005	2006	2007
130	133	127	106	96	96	95	87
2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	
80,0	83,22	90,27	92,16	89,88	86,01	98,13	

28 International Waters

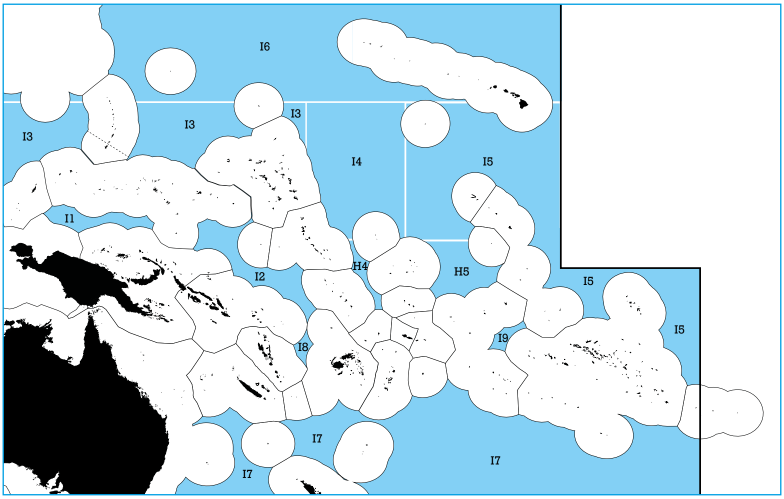
Volumes and Values of Fish Harvests in International Waters (IW)

Eleven different bodies of international water (IW) in the western and central Pacific Ocean (WCPO) are recognised in the current SPC/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 Is. Nauru, Tuvalu
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 reminder of 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 (2015)



Source: SPC, Oceanic Fisheries Programme

Figure 28-1: Figure 28-1: The 11 Bodies of International Waters in the WCPO
Key: Refer to Table 28-1, above

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries Commission for the years 1997–2014 have been made by the Forum Fisheries Agency (FFA 2015), using data sourced from the Oceanic Fisheries Programme of the Pacific Community. 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 Table 28-2, below. The figures presented have been modified from FFA (2015) to reflect bycatch and the "in-zone" value.

Table 28-2: Volume and Values of Fisheries Production from International Waters

	2010	2011	2012	2013	2014
Purse seine volume (mt)	76,935	66,851	89,075	89,631	134,547
Longline volume corrected for bycatch (mt)	122,954	112,538	115,668	111,033	89,754
Pole and line volume (mt)	69,778	66,653	72,271	43,184	38,273
Trolling volume (mt)	307	472	235	390	284
Other gear volume (mt)	363	130	129	129	129
Purse seine value corrected (US$)	88,672,647	105,784,008	164,819,374	156,912,557	174,282,948
Longline value corrected (US$)	601,792,736	612,143,019	603,716,683	455,815,610	384,547,760
Pole and line value corrected (US$)	147,975,132	155,874,804	221,743,431	95,891,453	93,543,816
Trolling value corrected (US$)	739,103	1,293,091	747,441	881,712	735,106
Other gear value corrected (US$)	442,753	213,930	280,594	251,982	203,460
Total volume corrected (mt)	270,338	246,644	277,378	244,366	262,988
Total value corrected (US$)	839,622,371	875,308,852	991,307,523	709,753,315	653,313,090

Source: FFA (2015)

Using the table above, FFA (2015) and some SPC unpublished data, the following observations can be made on catches:

- In 2014 the fish catches in the 11 bodies of international waters in the WCPO (262,988 mt) are equal to about 14.4% of all offshore catches in the zones of the 22 countries and territories of the Pacific Islands area.
- The fleets that had the most catches by volume in 2014 in the international waters were Japanese pole-and-line (17% of the total IW catch), USA purse seine (13%), Kiribati purse seine (11%), Japan purse seine (10%) and Philippine purse seine (9%).
- Of the fleets flagged in PICTs, the fleets that had the most catches by volume in 2014 in the international waters were Kiribati purse seine (11% of the total IW catch), Vanuatu longline (3%), Fiji longline (1%) and PNG purse seine (1%).

29 Fishery 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 and subsistence fishing) farm gate prices. 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, dealing with volume of production, the figures for aquaculture are expressed in both mt (e.g. for seaweed) and pieces (e.g. for giant clams, coral, and sometimes pearls).

Table 29-1: Volume of Fishery Production by Category for Countries and Territories in 2014 (mt)

Country/Territory	Coastal Commercial	Coastal Subsistence	Offshore Locally Based	Offshore Foreign Based	Freshwater	Total	Aquaculture	
							mt	Pieces
Kiribati	7,600	11,400	510	701,067	0	720,577	255	8,642
PNG	6,500	35,000	216,896	217,871	20,000	496,267	145	160,000
Nauru	163	210	0	177,315	0	177,688	0	0
FSM	1,725	3,555	40,838	124,481	1	170,600	8	37,400
Marshall Islands	1,500	3,000	85,918	29,754	0	120,172	0	10,000
Solomon Islands	6,468	20,000	41,523	36,573	2,300	106,864	1,530	20,000
Tuvalu	300	1,135	0	96,898	2	98,335	1	0
Fiji	11,000	16,000	17,079	0	3,731	47,810	205	85,236
Tokelau	40	360	0	24,286	0	24,686	0	0
Cook Islands	150	276	194	20,342	5	20,967	12	52,000
Vanuatu	1,106	2,800	568	10,942	80	15,496	43	27,300
French Polynesia	5,666	2,350	5,390	0	100	13,506	101	8,361,500
Samoa	5,000	5,000	1,254	0	10	11,264	12	0
Tonga	3,900	3,000	1,363	1,891	1	10,155	0	1,291
Palau	865	1,250	3,987	4,017	1	10,120	22	343,800
New Caledonia	1,350	3,500	2,876	0	10	7,736	1,733	0
American Samoa	42	120	2,154	0	1	2,317	9	0
Wallis and Futuna	150	675	0	0	0	825	0	0
Niue	11	154	0	547	0	712	0	0
Northern Marianas	142	350	0	0	0	492	41	15,000
Guam	72	42	0	0	3	117	100	0
Pitcairn Islands	3	6	0	0	0	9	0	0
Total	53,753	110,183	420,550	1,445,984	26,245	(see next section)	4,217	9,122,169

Source: Country and territory chapters of this book

Table 29-2: Value of Fishery and Aquaculture Production by Fishery Category for Countries and Territories in 2014 (US$)

Country/Territory	Coastal Commercial	Coastal Subsistence	Offshore Locally Based	Offshore Foreign Based	Freshwater	Aquaculture	**Total**
Kiribati	15,459,836	16,259,016	3,606,557	1,111,106,457	0	237,506	**1,146,669,373**
PNG	50,583,658	66,731,518	312,719,079	311,048,127	38,132,296	1,228,288	**780,442,964**
FSM	5,000,000	8,800,000	85,342,200	228,148,080	8,000	164,800	**327,463,080**
Nauru	1,071,275	965,438	0	231,229,508	0	0	**233,266,220**
Solomon Islands	12,848,296	33,027,523	57,520,263	79,228,378	3,800,786	773,263	**187,198,510**
Marshall Islands	4,350,000	6,000,000	133,530,000	38,700,638	0	50,000	**182,630,638**
Fr. Polynesia	31,107,594	11,466,127	28,829,104	0	487,920	89,771,222	**161,661,967**
Tuvalu	747,951	1,120,287	0	131,951,751	1,639	820	**133,822,448**
Fiji	37,878,788	29,292,929	54,364,955	0	3,741,414	1,452,307	**126,730,392**
Cook Islands	1,328,125	1,562,500	2,265,625	57,153,854	29,297	855,469	**63,194,870**
New Caledonia	9,324,366	16,916,335	13,416,896	0	48,334	18,786,304	**58,492,235**
Palau	3,200,000	3,300,000	31,471,000	18,555,070	10,000	285,000	**56,821,070**
Vanuatu	5,584,821	7,429,519	1,474,009	26,402,602	232,875	383,377	**41,507,203**
Tonga	18,064,516	10,053,763	4,177,419	5,058,065	3,226	15,054	**37,372,043**
Samoa	17,782,427	12,447,699	4,666,309	0	22,703	27,615	**34,946,752**
Tokelau	109,375	689,063	0	33,203,125	0	0	**34,001,563**
Wallis and Futuna	1,528,585	6,534,699	0	0	0	0	**8,063,283**
American Samoa	244,000	487,000	5,113,395	0	4,000	44,500	**5,892,895**
Northern Marianas	821,356	1,400,000	0	0	0	1,130,000	**3,351,356**
Niue	116,016	1,136,953		1,519,487	0	0	**2,772,455**
Guam	388,996	158,358	0	0	11,000	800,000	**1,358,354**
Pitcairn	14,063	9,375	0	0	0	0	**23,438**
Total	217,554,042	235,788,102	738,496,811	2,273,305,141	46,533,490	116,005,524	**(see next section)**

Exchange rates as given in country and territory chapters
Source: Country and territory chapters of this book

To compile the regional totals for the six fishery categories, some adjustments have 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. FFA (2015) and unpublished data from SPC (P. Williams, per. com. January 2016) have been used to estimate the offshore catches by vessels based in Pacific Island countries in the zones of other Pacific Island countries. In Tables 29-3 and 29-4, these amounts are subtracted from the totals when combining the categories of "offshore locally based" and "offshore foreign based" across the region.

Table 29-3: Regional Volume of Fishery Production by Category in 2014 (mt)

	Coastal Commercial	Coastal Subsistence	Offshore		Freshwater	Aquaculture*	Regional Total
			Offshore Locally Based	Offshore Foreign Based			
Totals	53,753	110,183	420,550	1,445,984	26,245		
Totals Adjusted for Duplicate Offshore Fishing	53,753	110,183	1,823,561		26,245		2,013,742

* Table does not include aquaculture due to difference in units (mt and pieces)
Source: Table 29-1, FFA (2015), and SPC (unpublished data)

Table 29-4: Regional Value of Fishery and Aquaculture Production by Category in 2014 (US$)

	Coastal Commercial	Coastal Subsistence	Offshore		Freshwater	Aquaculture*	Regional Total
			Offshore Locally Based	Offshore Foreign Based			
Totals	217,554,04	235,788,102	738,496,811	2,273,305,141	46,533,490	116,005,524	
Totals Adjusted for Duplicate Offshore Fishing	217,554,042	235,788,102	2,632,343,480		46,533,490	116,005,524	3,248,224,638

Source: Table 29-2, FFA (2015), and SPC (unpublished data)

The total fishery and aquaculture production of the zones of the 22 Pacific Island countries and territories in 2014 is estimated to be about 2.0 million mt, worth about US$3.2 billion.[1] 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, then the totals increase to 2.3 mt and US$3.9 billion.

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 low producing countries are discernible. More detailed information on each country is presented in the country and territory chapters.

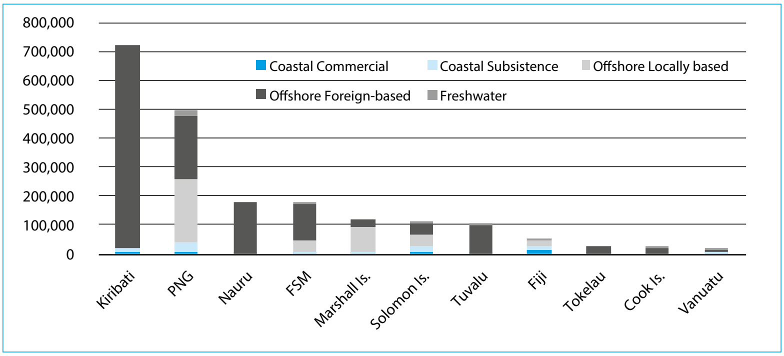


Figure 29-1: Volume of Fishery Production by Category in the Higher-Producing Countries/Territories in 2014 (mt)

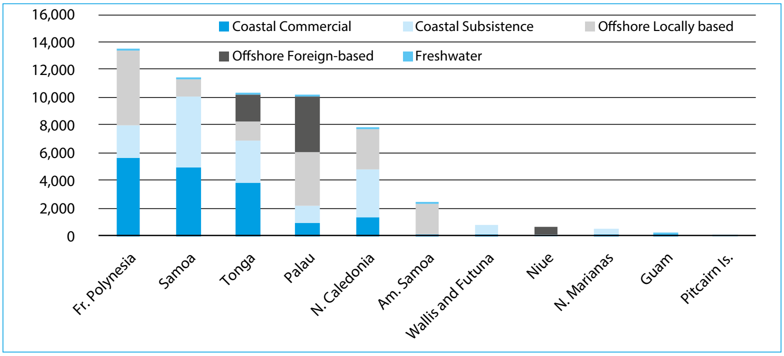


Figure 29-2: Volume of Fishery Production by Category in the Lower-Producing Countries/Territories in 2014 (mt)

1 For the offshore fisheries, the volumes are different from those given in FFA (2015) as those of the present study include bycatch. The values are also different as those of the present study include the value of the bycatch and are "in-zone" values whereas those of FFA (2015) are destination values (e.g. value in Japan or Thailand).

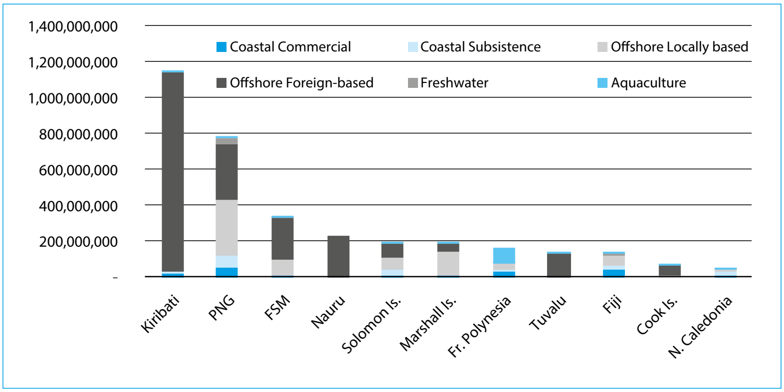


Figure 29-3: Value of Fishery Production by Category in the Higher-Producing Countries/Territories in 2014 (US$)

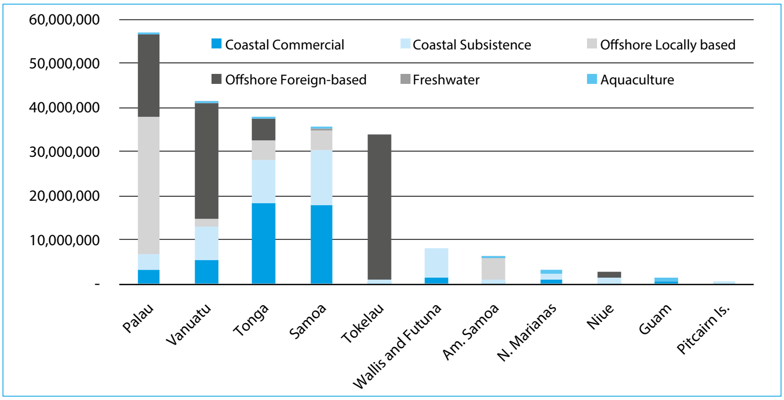


Figure 29-4: Value of Fishery Production by Category in the Lower-Producing Countries/Territories in 2014 (US$)

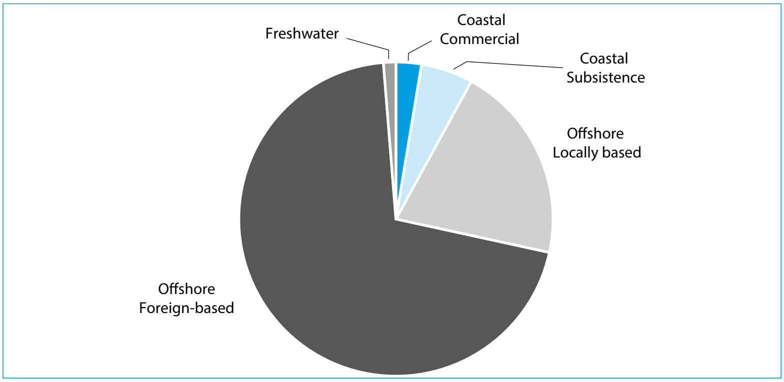


Figure 29-5: Share of Regional Fishery Production Volume by the Different Fishery Categories (Excluding Aquaculture) (%)

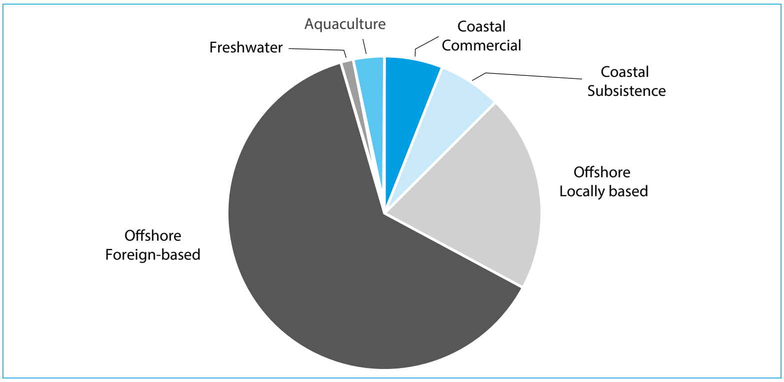


Figure 29-6: Share of Regional Fishery Production Value by the Different Fishery Categories (Excluding Aquaculture) (US$)

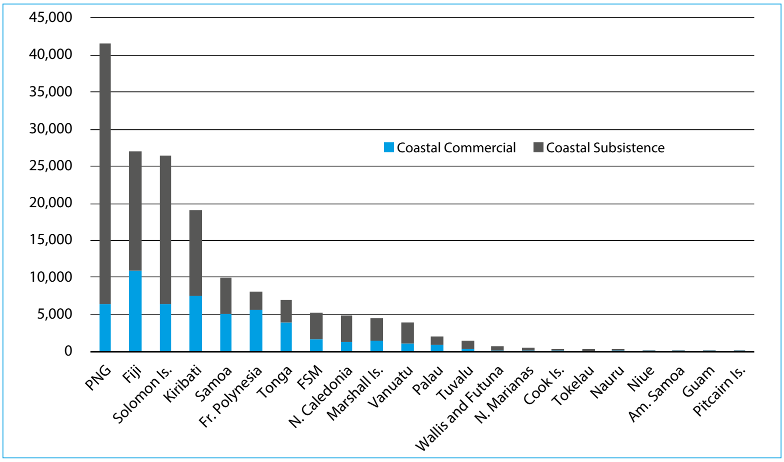


Figure 29-7: Coastal Fishery Production (Volume, mt) in the Countries and Territories

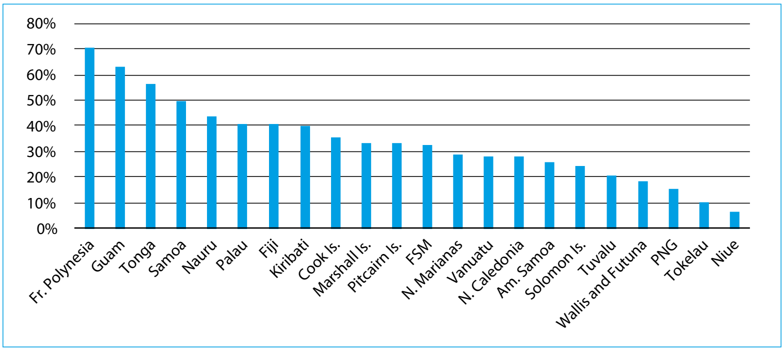


Figure 29-8: Coastal Commercial Fishery Production Volume as a Percentage of All Coastal Fishery Production Volume for each Country/Territory

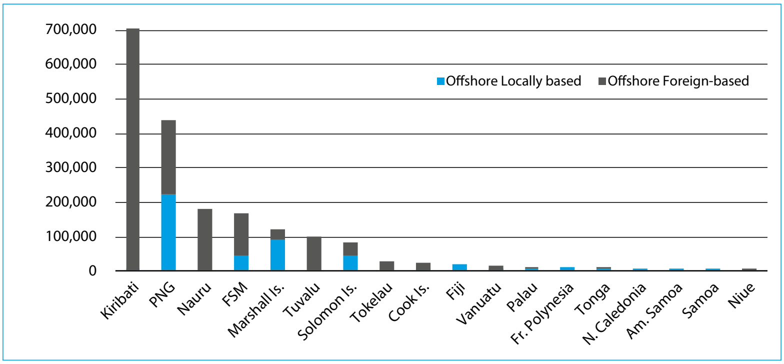


Figure 29-9: Offshore Fishery Production (Volume, mt) by Country/Territory

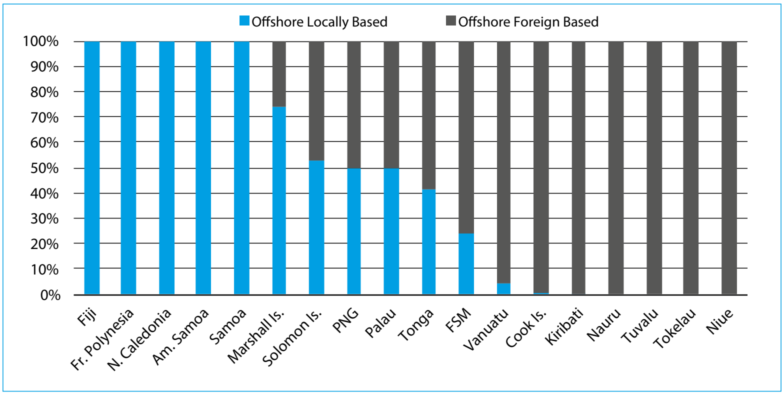


Figure 29-10: Locally Based vs Foreign-Based Offshore Fishing

Another way of looking at offshore fishing is the catch per square kilometre of each country's 200-mile zone. The combined 2014 production from locally and foreign-based offshore fishing was divided by the area of each 200-mile zone, and the results are shown in Figure 29-11.

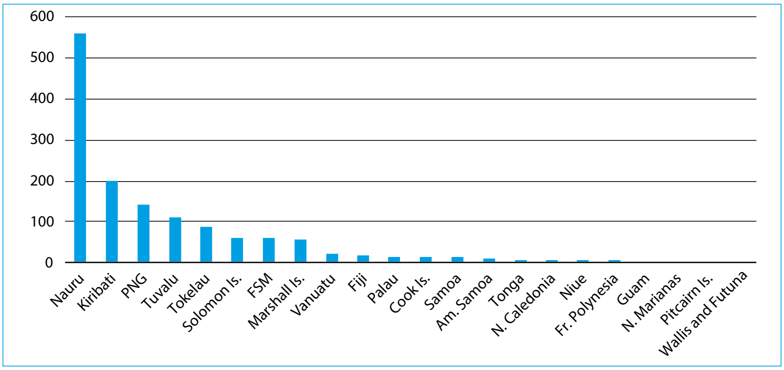


Figure 29-11: Offshore Catch Per Square Kilometre for Countries and Territories in 2014 (kg/km²)

The highest density of production was in the PNA[2] countries[3], with the exception of Palau.

29.2 Some Observations on Fishery Production in the Region

The regional fishery production in 2014 is estimated to be 2,013,742 mt of fish, worth US$3,248,224,638. In comparing these figures to others, 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 29-4 gives the value per metric tonne by fishery category across the region. The unit value of coastal commercial fisheries (US$4,047/mt) is greater than any of the other four fishery categories, and 2.5 times the unit value of offshore 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 29-4: Value per Metric Tonne by Fishery Category across the Region

	Coastal Commercial	Coastal Subsistence	Offshore Locally Based	Offshore Foreign Based	Freshwater
Total Value (US$)	217,554,042	235,788,102	738,496,811	2,273,305,141	46,533,490
Total Volume (mt)	53,753	110,183	420,550	1,445,984	26,245
Unit Value (US$/mt)	4,047	2,140	1,756	1,572	1,773

Earlier studies by FFA and ADB compared the production from offshore fisheries to that from coastal fisheries. In the present study the total production,

2 The Parties to 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.

3 Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu.

by volume, from offshore fisheries of the region is almost nine times that of coastal fisheries. By value it is only about 5.6 times greater – due to the high unit value of coastal fishery production and very high value of some coastal commodities (e.g. beche-de-mer).

Some of the other notable features of the overall fishery production of the region are as follows:

- The total production from the region in 2014 (2,013,742 mt) divided by the population of the region in 2014 (10,776,937 people) equates to 187 kg of fish per person.
- Fiji and French Polynesia are the only two countries among the top producing countries whose production is not strongly tuna oriented.
- Comparing the two pie charts on volume and value, the share for coastal commercial fishing is larger on the value chart due to its high unit value, and the share for offshore foreign-based fishing is lower due to the low unit value for purse seine fishing.
- 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-third 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.
- The degree of commercialisation of the coastal fisheries of Tonga and Samoa appears to be surprisingly high.
- The degree of commercialisation of the coastal fisheries of New Caledonia and American Samoa appears to be surprisingly low.

Notable features of offshore fisheries are as follows:

- 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 fishery production are readily apparent, with greater catches in the central equatorial region.

- Three countries in an area of relatively good tuna fishing had no locally based offshore fishery production in 2014: Nauru, Tuvalu, and Tokelau. A fourth country, Kiribati, had just 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 all locally based; in one third it is a mixture of locally and foreign based; and in one third it is all foreign based.
- Although Palau is a PNA country, the production from its offshore fishing is lower than that from several non-PNA countries.

29.3 Aquaculture Production in the Region

Aquaculture production in the region deserves some additional attention owing to its high level of promotion and support by governments and regional agencies. There appears to be a considerable disparity between the aspirations for aquaculture production and the reality shown by the data collected by this study. The reasons for this include inadequate critical assessment of this sector. An independent SPC-funded review of aquaculture in the region found that development organisations and government fishery departments in the region have paid insufficient attention to economic analysis and development realities when promoting aquaculture (Hambrey 2011). Additional attention on aquaculture production in the present report is justified by the continuing interest shown by governments in aquacluture, and the optimistic regional production estimates made in the past by aquaculture promoters.

In 2014 aquaculture production in the region was estimated at 4,217 mt and 9,122,169 pieces, worth US$116,005,524 (3.6% of the value of all fisheries and aquaculture in the region). The value of production by country/territory is shown in Figure 29-12.

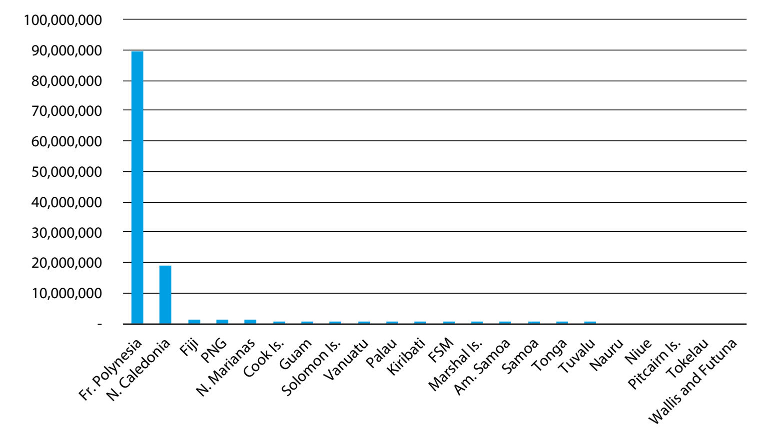


Figure 29-12: Value of Aquaculture Production by Countries and Territories in 2014 (US$)

The figure shows an important reality two French territories were responsible for over 93% of the value of all aquaculture production in the region in 2014. The leading aquaculture activities in 2014 are given in Table 29-6.

Table 29-6: Leading Aquaculture Activities in 2014

Commodity	US$ Millions
Pearls in French Polynesia	87.9
Shrimp in New Caledonia	17.9
Pearls in the Cook Islands	0.9
Seaweed in Solomon Islands	0.7
Shrimp broodstock in Northern Marianas	0.6
Pearls in Fiji	0.5
Shrimp in Northern Marianas	0.5

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 economic 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 have aquaculture conditions that are very different to the rest of the region. Figure 29-13 shows aquaculture production in the region excluding French Polynesia, New Caledonia, and PNG.

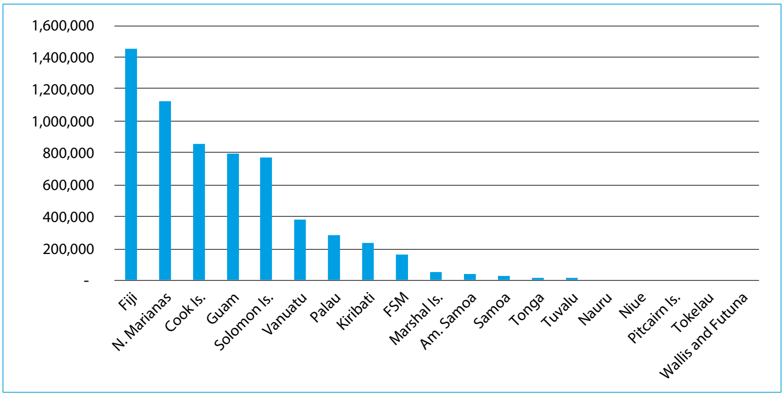


Figure 29-13: Value of Aquaculture Production Excluding Three Atypical Countries/Territories (US$)

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.
- Giant clams, mostly private sector and mostly in Micronesia.
- Seaweed in mostly low-wage countries (Solomon Islands, Kiribati) and in Fiji.
- Substantial amounts of tilapia in Fiji and Vanuatu, 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, 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. worth more than US$50,000) in only about half of PICTs.
- Five countries or territories have aquaculture production worth more than US$1 million, with three of those being the aforementioned atypical ones.
- Giant clam culture is important in the region, but several producers have the perception that over-production 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 Vanuatu, Northern Marianas and Fiji) and pearl culture (in Fiji, Tonga and the Cook islands). For example, the relatively low value mabe pearls that are grown in Tonga are mostly sold directly to tourists and had an average farm gate value in 2014 of US$26.88 per pearl. The average farm gate value in 2014 for the relatively high quality round pearls from French Polynesia was US$10.53 per pearl.

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.

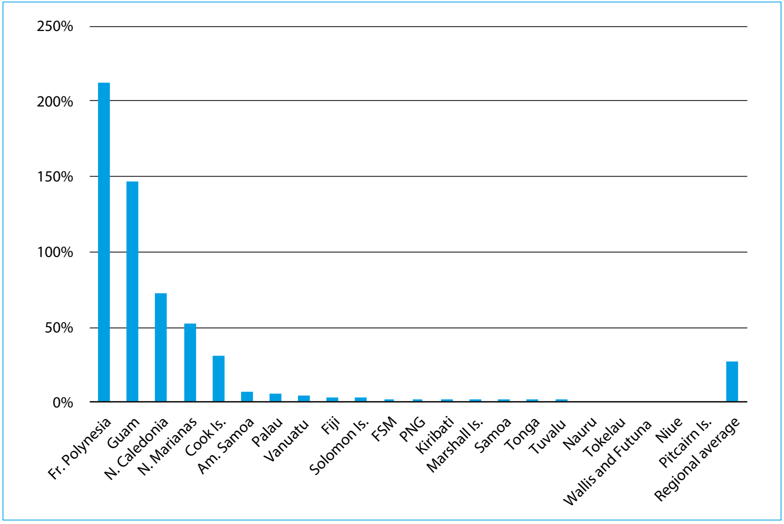


Figure 29-14: Value of Aquaculture Production as a Percentage of Coastal Fishery Production

In five territories and one country, the value of aquaculture production in 2014 was greater than 5% of the coastal fishery value. Government subsidies undoubtedly affect aquaculture production in several countries in the region but an examination of subsidies is beyond the scope of the present project – other than the observation that the aquaculture literature of the region contains little information on subsidies.

There is another point to be made about statistics on regional aquaculture production: the overly optimistic assessments of production by some aquaculture promoters. An SPC review of aquaculture in the Pacific Islands between 1998 and 2007, focused on "tracking a decade of progress through official and provisional statistics", estimated the US$ farm gate value of aquaculture production in the region in 2007 to be US$211 million (Ponia 2010). In contrast, the previous book in the Benefish series (Gillett 2009) estimated the US$ farm gate value of aquaculture production in the region in 2007 to be US$147 million. An SPC report, Hambrey (2011), reviewed aquaculture in the region and noted the following relating to aquaculture production in the Marshall Islands:

> Production figures are potentially confusing: MIMRA annual reports and interview data produced for SPC (Ponia 2010) suggest around 30,000 and up to 90,000 clams are sold per year. However, export permit records, CITES records and, most crucially, the sole exporter's own records, suggest the most accurate estimate would be considerably lower – in the region of 6,000–15,000 per year.

Similarly, the Ponia (2010) report may overestimate the aquaculture contribution to GDP:

> Aquaculture accounts for 22 per cent of total contribution of the fisheries sector's GDP[4], which is less than that provided by locally based offshore fisheries (31 per cent), almost on par with the amount from coastal subsistence fisheries (27 per cent), and more than the combined value from commercial coastal fisheries (17 per cent) and freshwater fisheries (3 per cent).

In light of the above discussion, two points made in the 2009 Benefish study are worth repeating: (1) there should be periodic objective analysis of net benefits and potential of aquaculture development initiatives; and (2) the analysis of benefits from specific fishery subsectors should not be carried out by those involved in promoting that subsector. The SPC review of aquaculture in the region by Hambrey (2010) catered to both of these concerns.

The Hambrey report is also relevant to another aquaculture issue. The report stressed the need for economic analysis of aquaculture initiatives. Although that is true (and there certainly needs to be more rigorous economic analysis of aquaculture in the region), observations during the present study indicate a growing attitude that it is only commercial aquaculture that requires

4 The contribution of aquaculture in 2007 was 12% in the Gillett (2009) study.

economic scrutiny, and that aquaculture for "food security" does not require such analysis. It is the contention of the present report that all aquaculture initiatives should be guided by rigorous economic analysis, and those for food security should include comparative economic investigations of food security options outside the fisheries/aquaculture sector.

29.4 Changes in Fishery Production Between 2007 and 2014

In previous studies of fisheries-related benefits to Pacific Island countries and territories ("Benefish" studies), Gillett and Lightfoot (2001) focused on the year 1999, Gillett (2009) focused on 2007, and the present study focuses on 2014. The 2001 study did not include the eight non-independent territories, nor did it cover freshwater fisheries and aquaculture. The 2009 study and the present study 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 for the three-year period represents a real change in production in some cases, but this can also represent a change in the methodology 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 many 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 and aquaculture 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 volumes because of the mix of units of production.

Changes in Volumes of Fishery Production

In the 22 countries and territories the total volume of fishery production in the period between 2007 and 2014 increased by 431,354 mt, or 32%. The changes in volume of the fishery production in each of the PICTs are given in the country and territory chapters. Table 29-6 compiles the results.

Table 29-6: Volume of Fishery Production by Country/Territory, 2007 vs 2014 (mt)

		Coastal Commercial	Coastal Subsistence	Offshore Locally Based	Offshore Foreign Based	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**
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**
Nauru	2007	200	450	0	69,236	0	**69,886**
	2014	163	210	0	177,315	0	**177,688**
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**
Solomon Is.	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**
Marshall Is.	2007	950	2,800	63,569	12,727	0	**80,046**
	2014	1,500	3,000	85,918	29,754	0	**120,172**
Tuvalu	2007	226	989	0	35,541	0	**36,756**
	2014	300	1,135	0	96,898	2	**98,335**
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**
Tokelau	2007	0	375	0	318	0	**693**
	2014	40	360	0	24,286	0	**24,686**
Cook Is.	2007	133	267	3,939	0	5	**4,344**
	2014	150	276	194	20,342	5	**20,967**
Vanuatu	2007	538	2,830	0	12,858	80	**16,306**
	2014	1,106	2,800	568	10,942	80	**15,496**
Fr. Polynesia	2007	4,002	2,880	6,308	0	100	**13,290**
	2014	5,666	2,350	5,390	0	100	**13,506**
Samoa	2007	4,129	4,495	3,755	25	10	**12,414**
	2014	5,000	5,000	1,254	0	10	**11,264**
Tonga	2007	3,700	2,800	1,119	0	1	**7,620**
	2014	3,900	3,000	1,363	1,891	1	**10,155**
Palau	2007	865	1,250	3,030	1,464	1	**6,610**
	2014	865	1,250	3,987	4,017	1	**10,120**
N. Caledonia	2007	1,350	3,500	2,122	0	10	**6,982**
	2014	1,350	3,500	2,876	0	10	**7,736**
Am. Samoa	2007	35	120	6,632	0	1	**6,788**
	2014	42	120	2,154	0	1	**2,317**
Wallis-Futuna	2007	121	840	0	0	0	**961**
	2014	150	675	0	0	0	**825**
Niue	2007	10	140	640	0	0	**790**
	2014	11	154	0	547	0	**712**
N. Marianas	2007	142	350	0	0	0	**492**
	2014	231	220	0	0	0	**451**
Guam	2007	44	70	0	0	3	**117**
	2014	72	42	0	0	3	**117**
Pitcairn	2007	5	7	0	0	0	**12**
	2014	3	6	0	0	0	**9**

Source: Country and territory chapters of this book

The information in Table 29-6 is displayed graphically in Figures 29-15 and 29-16 for the countries and territories separated into two groups (higher producing and lower producing) so that the volumes of the lower producing countries/territories are discernible.

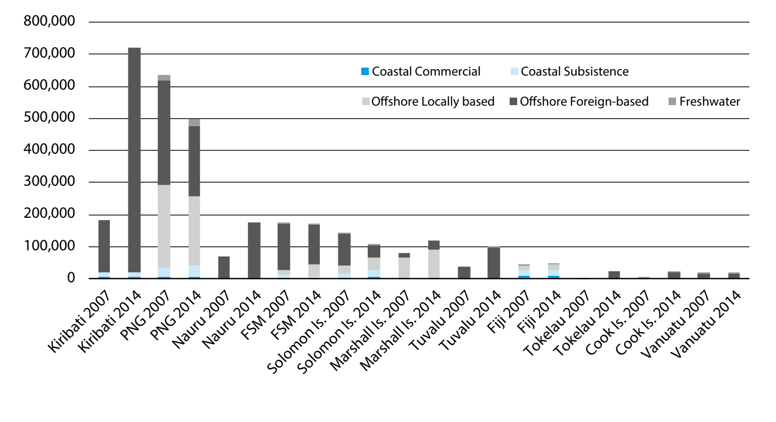


Figure 29-15: Change in Volume of Production of the Higher-Producing Countries/Territories, 2007–2014 (mt)

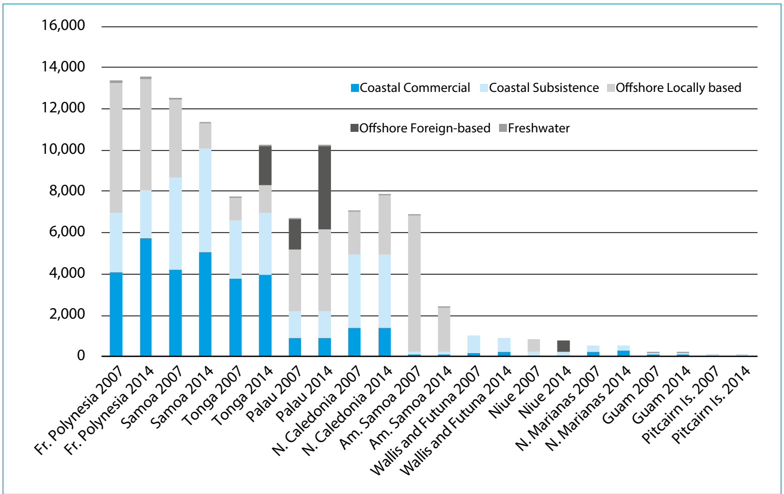


Figure 29-16: Change in Volume of Production of the Lower-Producing Countries/Territories, 2007–2014 (mt)

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 cause.

The following four figures separate the coastal fisheries and offshore fisheries for the higher and lower producing countries and territories.

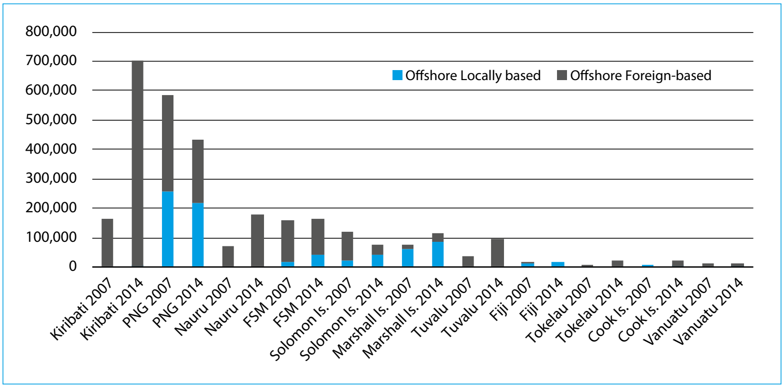


Figure 29-17: Changes in Volume of Offshore Production of the Higher Producing Countries/Territories, 2007–2014 (mt)

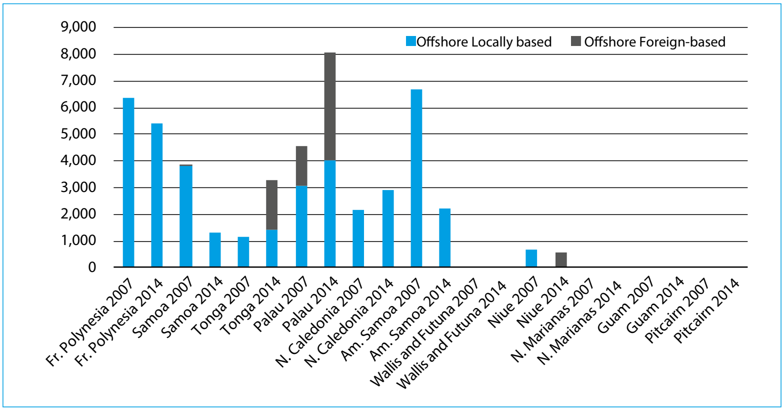


Figure 29-18: Changes in Volume of Offshore Production of the Lower-Producing Countries/Territories, 2007–2014 (mt)

The above figures show what is expected in an El Niño year such as 2014, that is, offshore production (especially by the mobile foreign-based purse seine fleets) shifted to the east. PNG production dropped and Kiribati production increased significantly along with (to a lesser extent) that of Tuvalu, Nauru, and Tokelau.

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.

Figures 29-19 and 29-20 shows changes in coastal fisheries.

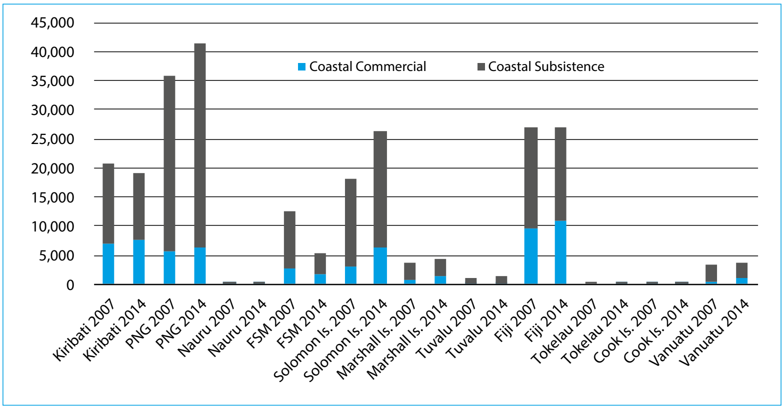


Figure 29-19: Changes in Volume of Coastal Production of the Higher-Producing Countries/Territories, 2007–2014 (mt)

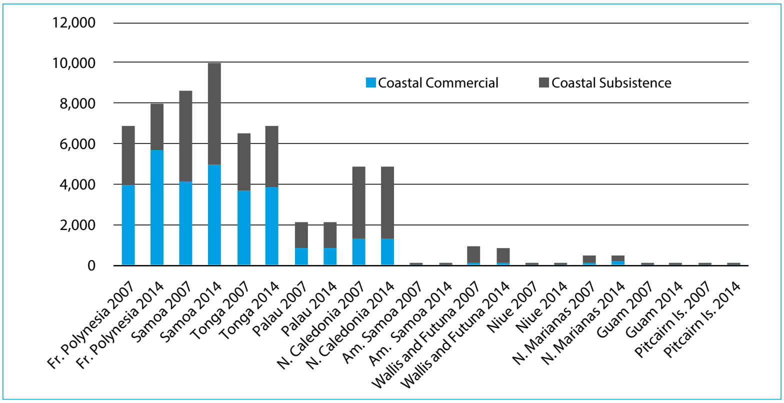


Figure 29-20: Changes in Volume of Coastal Production of the Lower-Producing Countries/Territories, 2007–2014 (mt)

Most of the change between 2007 and 2014 in coastal fisheries appears to be due to the rise and fall of coastal commercial production, with coastal subsistence production being more stable.

Figures 29-21 and 29-22 show the changes in the contribution of the different fishery categories to the overall fishery production, by volume, between the two years.

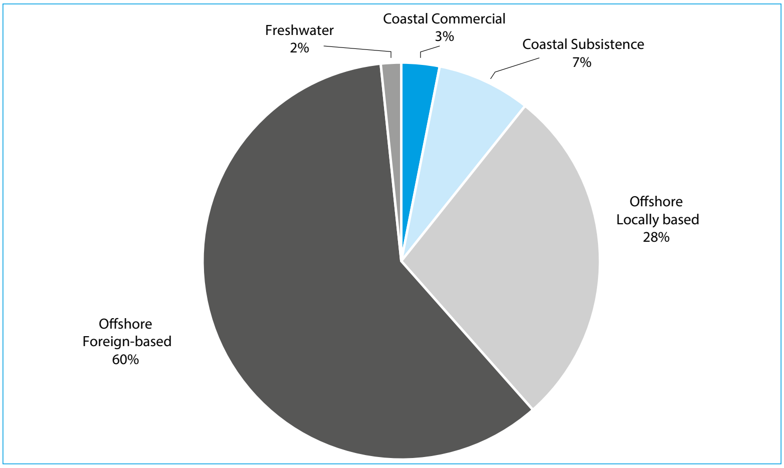


Figure 29-21: Contribution of the Fishery Categories to the Total Fishery Production, by Volume, 2007

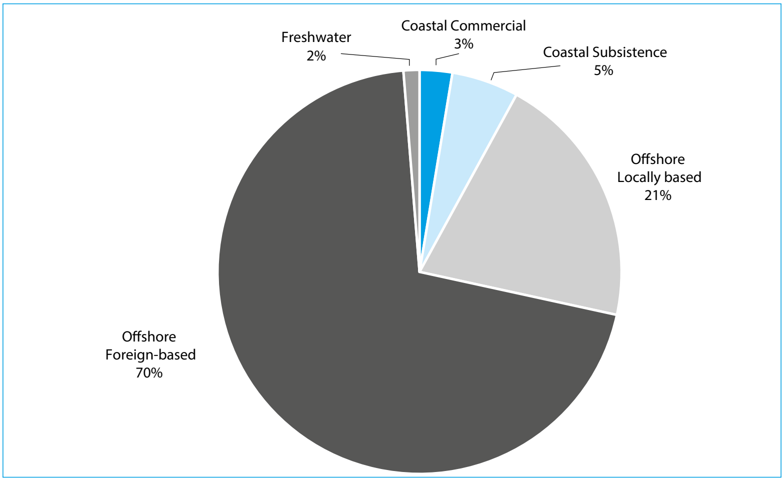


Figure 29-22: Contribution of the Fishery Categories to the Total Fishery Production, by Volume, 2014

Comparing the figures, it can be seen that the share of offshore foreign-based fishing expanded, largely at the expense of offshore locally based fishing. Most of this was driven by the change in production of a single country – Kiribati.

Figure 29-23 shows the changes in the five fishery categories in absolute volumes.

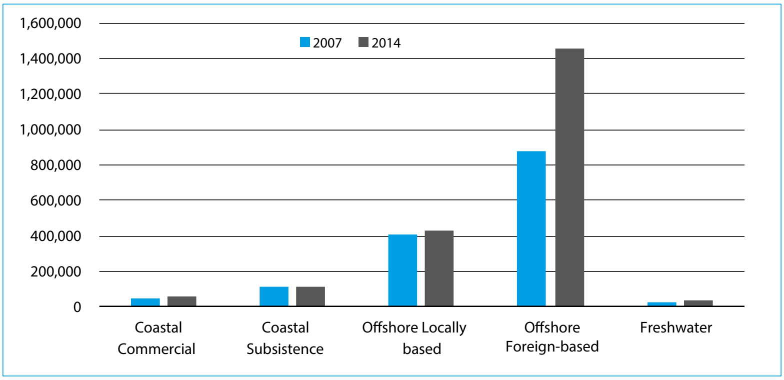


Figure 29-23: Volume of Production by Fishery Category, 2007 vs 2014 (mt)

The most striking feature of the graph, the large increase in production by offshore foreign-based fishing, could represent an actual increase in foreign-based offshore fishing, but more likely it reflects an El Niño-driven shift from the west (where there are lots of locally based vessels) to the east (where there are fewer).

The above graphs include all 22 PICTs that were in the 2007 and 2014 Benefish studies. The 1999 Benefish study can be added in to the comparison – but the eight territories and freshwater/aquaculture need to be eliminated from all the studies. The reduced comparisons are shown in Table 29-7 and Figure 29-24.

Table 29-7: Fisheries Production, by Volume, of the Independent Pacific Island Countries/Territories in 1999, 2007 and 2014 (mt)

	Coastal Commercial	Coastal Subsistence	Offshore Locally Based	Offshore Foreign Based
1999	38,445	91,485	140,408	461,303
2007	39,001	101,921	386,034	864,367
2014	46,288	102,780	410,130	1,421,698

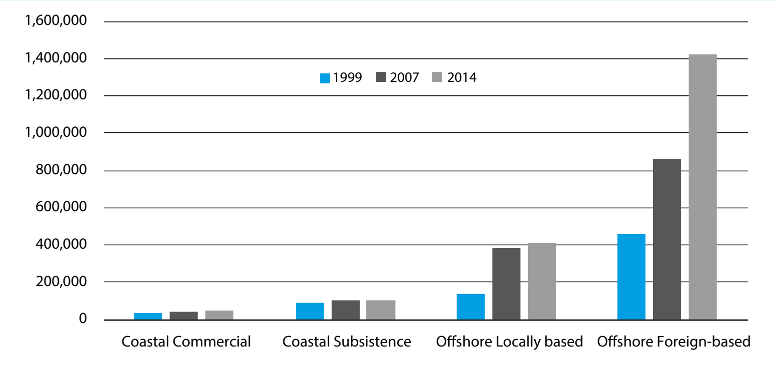


Figure 29-24: Fisheries Production, by Volume, of the Independent Pacific Island Countries /Territories in 1999, 2007 and 2014 (mt)

Comparing 1999, 2007 and 2014 reveals an important point: offshore fishery production is expanding, but coastal fishery production is largely stable – despite increasing coastal fishing effort in most countries and territories of the region.

A similar point is made in Table 29-8, below. As most of the domestically derived fish consumption in Pacific Island countries and territories comes from coastal fisheries, changes in per capita coastal fisheries production is an indicator of changes in per capita fish consumption from domestic fish supplies.

Table 29-8: Per Capita Coastal Fishery Production, 2007 vs 2014

	Coastal Commercial Production (mt)	Coastal Subsistence Production (mt)	Total Coastal Production (mt)	Total Population	Per capita coastal fisheries production (kg/person/year)
2007	39,001	101,921	140,922	9,302,213	15.1
2014	46,288	102,780	149,068	10,776,937	13.8

Changes in Values of Fishery Production

As mentioned above, there is no simple and accurate way to compare values of fishery products across the countries of the region over time. However, just for illustrative purposes, the present study inflates 2007 values by a factor of 1.173 (the composite CPI for USA, Australia, and New Zealand) to arrive at values in 2014 prices – to give an idea of changes in real values. 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.

Expressed in 2014 prices, in the 22 countries and territories the value of fishery and aquaculture production in the period between 2007 and 2014 increased by US$738,662,323, or 30.7%. The values of production from the six fishery categories changed at different rates as shown in Table 29-9 and Figure 29-25.[5]

Table 29-9: Values of Production from the Different Fishery Categories, 2007 vs 2014 (US$)

	Coastal Commercial	Coastal Subsis-tence	Offshore Locally Based	Offshore Foreign Based	Freshwater	Aquaculture
2007 (converted to 2014 US$ values)	194,355,545	235,030,445	700,089,319	1,274,560,202	27,113,924	172,281,352
2014	217,554,042	235,788,102	738,496,811	2,273,305,141	46,533,490	116,005,524
Change 2007–2014	11.9%	0.3%	5.5%	78.4%	71.6%	-32.7%

5 Noting the issue of double counting of offshore catches explained above, the difference in value 2007–2014 is not the same as the total of the changes in value of the six fishery categories in the table (i.e., adjustment has to be made for the double counting).

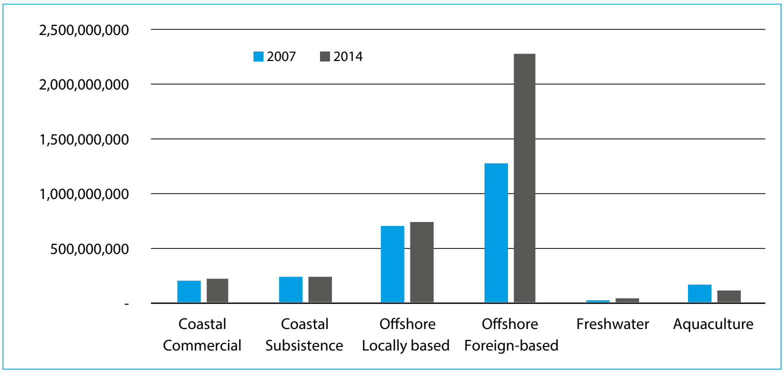


Figure 29-25: Values of Production from the Different Fishery Categories, 2007* vs 2014 (* Converted to 2014 US$ values).

Two features of the above table and graph require some explanation:

- The increase in the value of the freshwater production was due to a more realistic price being set for freshwater catches in PNG, which has by far the largest freshwater fishery in the Pacific Islands. Because the amounts of freshwater fish are relatively small, the 71.6% value increase is hardly discernible on the graph.
- The 32.7% decrease in the value of aquaculture is mostly due to the fall in value of pearl production in the Cook Islands (declined in real terms by 67.4%) and French Polynesia (declined by 29.2%).

Changes in the value of aquaculture in the region could be masked by events in the three atypical territories/country (French Polynesia, New Caledonia and PNG), such as the significant decline in pearl production in French Polynesia. The change in real value of regional aquaculture production over the period 2007–2014 was calculated excluding these three. Using 2007 values expressed in 2014 prices, the value dropped by US$694,477, or 8.9%.

The changes in the value of fishery production between 2007 and 2014 in each of the PICTs are provided in the country and territory chapters. Figure 29-26 shows the combined results. To show detail, Tokelau is not included in the figure (value of its fishery production increased 2,514%). As mentioned above, the changes should be considered approximate due to the method used for converting 2007 values to 2014 figures.

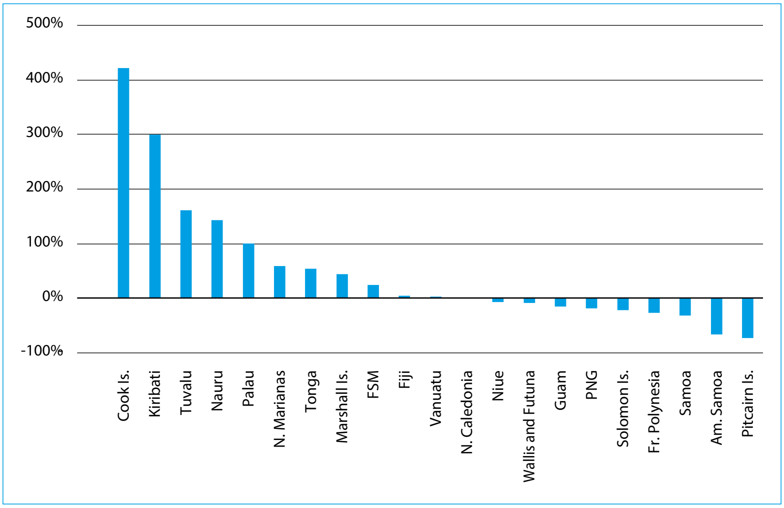


Figure 29-26: Changes in the Real Value of Fisheries and Aquaculture Production, 2007–2014

In the five countries that gained the most over the period (Tokelau, Cook Islands, Kiribati, Tuvalu, and Nauru), this was largely due to an "El Niño bonus". In the five biggest losers the reasons were more diverse and include the decline of locally based longlining (American Samoa, Samoa), the decline of pearl farming (French Polynesia), and an "El Niño penalty" (Solomon Islands).

29.5 Measuring Fishery Production in the Region

General issues

The situation for measuring fishery production in the region is very different for offshore fisheries and 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, 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.

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. 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.

The country and territory chapters of this book contain comments on the accuracy of national production data. In many of the country and territory chapters, following the table summarising national fisheries production, there 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."

Some additional observations from the present and past Benefish studies on measuring coastal fisheries production are made below:

- Few, if any, of the long-established fisheries statistical systems supported by national governments (or, more frequently, the remnants of old systems) provide good estimates of coastal fisheries production. Several countries in the region that have such systems continue to churn out (most likely dubious) production statistics. The main problem appears to be the common use of sampled fisheries or markets (with the amount of sampling generally shrinking over the decades) to estimate national production.
- At least half of the countries/territories are using data for annual coastal fishery production based on old or very old surveys (some carried out over 30 years ago). The numbers have been used repeatedly over the years and have become institutionalised, despite major changes in the fisheries and factors that affect fishery production. This is referred to as "inappropriate recycling of antiquated production information".
- 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 decade – in the Marshall Islands in 2010 and in Samoa in 2012.

- There is little dialogue between the staff of fishery departments and statistics agencies in the region. It is reportedly common throughout the region for staff of fisheries departments to be invited to meetings with statistics agencies but to not attend those meetings. Notable exceptions are FSM (which has an ex-fisheries person as head of statistics) and Cook Islands.
- All of the Pacific Island countries and territories have carried out, and will continue to carry out, household income and expenditure surveys (HIES). These are a major tool of statistical departments in the region, and all of the countries and territories have carried out HIES. Results can be used for estimating the contribution of coastal fisheries to GDP, however most fishery departments are failing to take advantage of this. For example, the fisheries agency of one large country in the region that has not carried out significant work in estimating coastal fisheries production expressed no interest in a re-analysis of a recent HIES to obtain coastal fisheries production information. In view of the poor statistics on coastal fishery production in most countries of the region, and the potential of the HIES to improve the situation, the applicability of the HIES to coastal fisheries deserves additional attention by fisheries departments.

Household Income and Expenditure Surveys

The HIES can give information on fishery production at little or no cost to fishery departments. However there have been doubts as to the accuracy of annual coastal fishery production estimates made from the results from HIESs.

The applicability of HIES to fisheries in the region has been the subject of several papers and a workshop. In a paper titled "Some Thoughts on the Interface between Fisheries and Household Income and Expenditure Surveys in the Pacific Islands", Gillett (2009) stated the following on the basis of observations during the 2009 Benefish study:

> A feature common in many countries of the 2009 Benefish Study is to have the coastal fisheries production estimated by a HIES to be relatively low. The HIES generally suggests fish catches significantly smaller than that estimated by other survey techniques or smaller than that perceived by specialists familiar with national fisheries. There were eight countries in the Benefish Study from

> which fisheries productions levels could be obtained from both a HIES and a more fisheries-focused estimate. In six of those countries the HIES indicated or suggested a lower production. In one country (Cook Islands) the estimates were similar, and in one country (Samoa) the HIES gave a similar estimate for subsistence and a higher estimate for coastal commercial fishing.

A workshop was convened on the use of the HIES in coastal fisheries in early 2009, and the results paper that was published contained the statement: "HIES should be modified to collect information in ways that are simple to understand and that make it easy to quantify, for each household, the fish caught for subsistence, purchased at local markets, sold, received as gifts and given as gifts" (Bell et al. 2009). Following the workshop SPC focused considerable attention on the development of a "fisheries-friendly" HIES. This is described in Box 29-1.

Box 29-1: Improved HIES for Fisheries Purposes

In 2013 SPC's Statistics for Development Division made major changes to the type of household income and expenditure survey it promotes in the Pacific Islands region. The new type of HIES is standardized across the countries in the region with respect to the questions asked, sampling methodology, data set, outputs, and reporting. Another feature of the new type of HIES is that the survey is more fisheries-relevant, especially for subsistence and small-scale commercial activities. It is easier to capture home production and household income from fisheries and to disaggregate by various types of catch (i.e. ocean fish, lagoon fish, invertebrates). Since 2013 the new type of HIES has been used in FSM, Nauru and Palau.

Source: M. Sharp (per. com. November 2015)

The FSM chapter indicates promising results from the new fisheries-friendly HIES, which should serve to encourage the fishery departments of the region to make more use of HIESs in their coastal fisheries work. In 2016 and 2017 several countries will be conducting an HIES: Kiribati, the Marshall Islands, PNG, and Vanuatu.

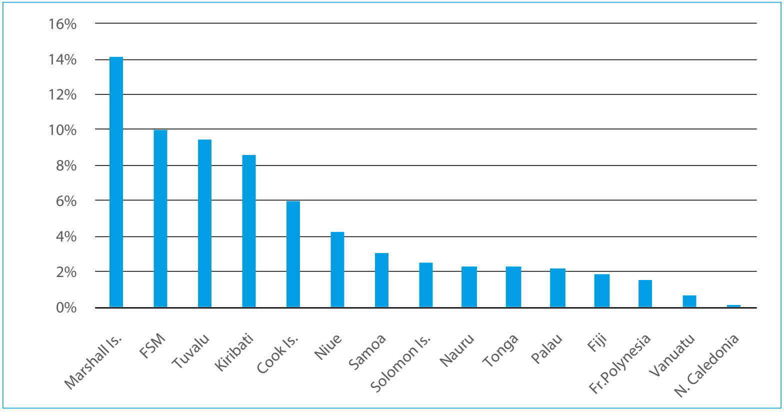
30 The Contribution of Fishing to GDP

30.1 The Official Contribution of Fishing to GDP

The official GDP and the official fishing contributions to GDP for the Pacific Island countries and territories are given in the country and territory chapters. Methods used in the calculation of the fishing contribution to GDP are also presented, and some comments are made on those methods. The official data from the chapters are summarised in Table 30-1.

Other relevant information includes general information on GDP in the introductory chapter, national accounting and the fisheries sector in Appendix 2, and guidelines for calculating the fishing contribution to GDP in Appendix 3.

The contribution of fishing to the official GDP is shown graphically in Figure 30-1.



Note: Not all countries calculate GDP (See Table 30-1)

Figure 30-1: The Percentage Contribution of Fishing to Official GDP

Table 30-1: Official Estimates of GDP and Fishing Contributions to GDP

Country	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	Comment
Cook Islands	382,800	22,800	299,063	17,813	6.0%	2014 (provisional)	"Fishing and pearl" contribution to GDP
FSM	318,100	31,800	318,100	31,800	10.0%	FY 2014	GDP contribution excludes that of foreign-owned locally based fishing vessels, but includes all fish processing and the shore-based services of the vessel-operating companies
Fiji	7,129,800	130,200	3,600,909	65,758	1.8%	2014 (provisional)	
Kiribati	192,851	16,553	158,075	13,568	8.6%	2014 (provisional)	"Fishing and seaweed" contribution to GDP
Marshall Islands	186,700	26,300	186,700	26,300	14.1%	FY2014	Excludes most of the locally based industrial fishing vessels but includes industrial processing operations
Nauru	142,100	3,200	116,475	2,623	2.3%	FY 2014	
Niue	31,273	1,337	24,432	1,045	4.3%	2014	
Palau	249,082	5,460	249,082	5,460	2.2%	FY 2014	Excludes foreign-owned locally based fishing vessels, but includes shore-based services of companies operating those vessels
PNG	43,200,000		16,809,339			2014	No official GDP estimate since 2006; IMF estimated GDP in 2014 to be K43.2 billion
Samoa	1,922,057	57,467	804,208	24,045	3.0%	2014	
Solomon Islands	7,819,541	194,251	1,024,842	25,459	2.5%	2014 (provisional)	

Table 30-1: continuation

Country	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	Comment
Tonga	803,700	18,200	432,097	9,785	2.3%	FY 2013/2014	
Tuvalu	38,512	3,631	31,567	2,976	9.4%	2012	
Vanuatu	75,803,000	485,000	739,469	4,731	0.6%	2014 (provisional)	
Territory							
American Samoa	711,000		711,000			2013	Official fishing contribution to GDP (if any) not available
French Polynesia	531,861,000	8,138,000	5,771,061	88,303	1.5%	2011	
Guam	4,882,000		4,882,000			2013	Official fishing contribution to GDP (if any) not available
New Caledonia	842,913,000	1,363,000	9,337,687	15,099	0.2%	2010	
Northern Marianas	682,000		682,000			2013	Official fishing contribution to GDP (if any) not available
Pitcairn Islands							No official GDP estimates made
Tokelau							No official GDP estimates made
Wallis and Futuna	18,000,000		87,500			2005	Official fishing contribution to GDP (if any) not available

Source: Country and territory chapters of this book

PNG is not shown in the figure as the last official GDP estimates were done in 2006 and the contribution of fishing to the 2006 GDP is not readily available. The fishing contribution to GDP in Marshall Islands is large due to including in the fishing sector industrial fisheries processing (see the Marshall Islands chapter for a discussion of this issue). The contribution of fishing to GDP in New Caledonia is relatively small due to the size of its economy – the second largest in the region after PNG.

In some countries/territories the methods used to calculate the fishing component of GDP were well documented. In others, this information was obtained verbally for the present study, and it is likely that at least some of this information was inaccurate for various reasons, including the provider being unfamiliar with the subject. This should be taken into account in considering comments on in the relative rigour of the methodology used in a particular country.

During the process of investigating the contribution of fishing to GDP and associated methodologies it was found that, in many of the Pacific Island countries and territories, the individuals responsible for calculating the contribution of fishing to GDP appeared to be unfamiliar with the technical basis of the methods they were using for determining the fishing contribution (some of these individuals were responsible for all of the other sectors also). According to discussions with some of these individuals, methods being used were developed by colleagues who had since departed. A "recipe" was being followed, but the rationale for many components was apparently not understood sufficiently to enable them, to explain the methodology.

Other important observations and issues that emerged during the process are as follows:

- Almost without exception, there is a great deal of enthusiasm among the staff of the national statistics agencies for learning more about the fishing sector and improving the estimation of its contribution to GDP.
- In most countries and territories there are few or no people with fisheries expertise involved in the estimation of fishing's contribution to GDP. 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 those people.

- Many countries and territories have recently had, or are expecting to have in the near future, external technical assistance for their national accounts from the Suva-based Pacific Island Financial Technical Assistance Centre (PIFTAC).
- A surprising number of GDP calculations dealing with fishing were done using input from a "specialised survey" or "informal survey" almost none of which were available for examination, and some of which seemed to have highly variable and to produce questionable results (e.g. an extremely small value-added ratio for a type of fishing that uses low technology).
- Many countries and territories use the results of "business surveys", 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 a question whether small-scale commercial fishing activity is captured by this methodology.
- Most countries and territories divide up the fishing sector into smaller components, which have similar characteristics with respect to value added. Problems occur when very dissimilar fisheries are aggregated into a single component (e.g. beche-de-mer diving and reef gleaning) or when important fisheries are overlooked.
- As discussed in the previous chapter, almost all countries and territories use the results of household income and expenditure surveys (HIES) in the process of estimating production from small-scale fisheries. The accuracy of the HIES for fisheries purposes therefore has a major impact on the fishing contribution to GDP across the region. This subject is covered in this report, above.

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. In comparison 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 in each country and territory. 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 figure, 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.

The re-estimate for each country/territory and the associated methodology are given in the country and territory chapters. The results are summarised and compared to the official estimate (where available) in Table 30-2. The re-estimated 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/territory chapter) to adjust national GDP to account for any significant increase or decrease in GDP due to a re-estimated fishing contribution.

Table 30-2: Official Estimates and Re-estimates of Fishing Contributions to GDP

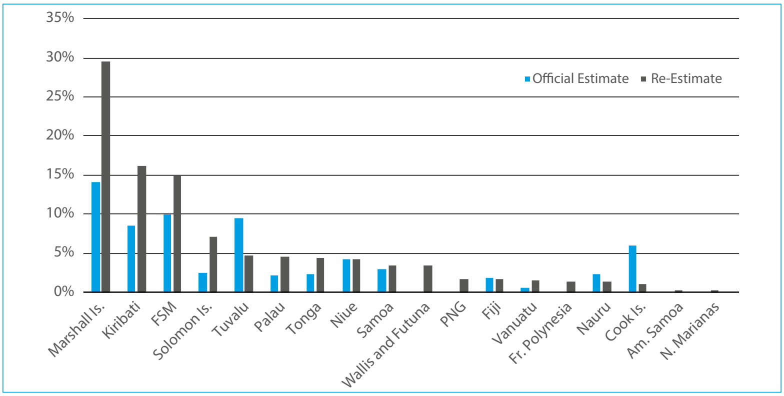
Country	Official Fishing Contribution to GDP (local currency '000s)	Re-estimate of Fishing Contribution to GDP (local currency '000s)	Official Fishing Contribution as % of Official GDP	Re-estimate of Fishing Contribution as % of Official GDP	Comments
Cook Islands	22,800	3,812	6.0%	1.0%	
FSM	31,800	47,244	10.0%	14.9%	
Fiji	130,200	117,461	1.8%	1.6%	
Kiribati	16,553	31,201	8.6%	16.2%	
Marshall Islands	26,300	55,093	14.1%	29.5%	
Nauru	3,200	1,844	2.3%	1.3%	
Niue	1,337	1,334	4.3%	4.3%	
Palau	5,460	11,505	2.2%	4.6%	
PNG		732,777		1.7%	No official GDP estimate since 2006; unofficial 2014 GDP used for comparison
Samoa	57,467	65,334	3.0%	3.4%	
Solomon Islands	194,251	559,352	2.5%	7.2%	

Table 30-2: continuation

Country	Official Fishing Contribution to GDP (local currency '000s)	Re-estimate of Fishing Contribution to GDP (local currency '000s)	Official Fishing Contribution as % of Official GDP	Re-estimate of Fishing Contribution as % of Official GDP	Comments
Tonga	18,200	35,759	2.3%	4.4%	
Tuvalu	3,631	1,803	9.4%	4.7%	2012 GDP used for comparison
Vanuatu	485,000	1,155,580	0.6%	1.5%	
Territory					
American Samoa		1,642		0.2%	2013 GDP used for comparison
French Polynesia	8,138,000	7,037,203	1.5%	1.3%	Unofficial 2014 GDP used for comparison
Guam		882		0.0%	2013 GDP used for comparison
New Caledonia	1,363,000	3,019,914	0.2%	0.4%	
Northern Marianas		2,121		0.3%	2013 GDP used for comparison
Pitcairn Islands		23			No official GDP estimates made
Tokelau		943			No official GDP estimates made
Wallis and Futuna		610,500			No official GDP estimate since 2005

Source: Country and territory chapters of this book

The official contributions of fishing to GDP are compared to the re-estimates in Figure 30-2 below.



Note: 2014 or latest year available

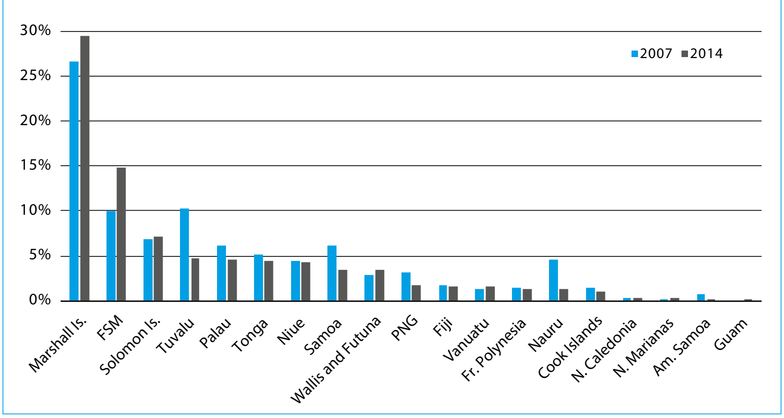
Figure 30-2: Official vs Re-estimated Fishing Contributions to GDP

The differences for the Marshall Islands and FSM involve intentional inclusions/exclusions of industrial fishing and processing as discussed in the country and territory chapters. It is likely that the large differences for Kiribati, Solomon Islands, Tuvalu, and Cook Islands are due to flaws in the official methodology.

Some of the reasons for the differences between the official and the re-estimated figures are as follows:

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

The 2009 Benefish study (Gillett 2009) and the present study used similar methods to recalculate fishing contributions to GDP, and subsequently express them as a percentage of each country's or territory's GDP. The results of the two studies are therefore comparable and may give insight into the real changes over the 2007–2014 period (Figure 30-3).



Source: The present study, and Gillett (2009)

Figure 30-3: Percentage Fishing Contributions to GDP, 2007 vs 2014

In the figure the impacts of increased local basing of offshore fishing vessels in the Marshall Islands and FSM are quite apparent. The large difference for Tuvalu is due to having better price information to value subsistence production. The large difference for Samoa is mostly caused by a drop in the production of locally based longliners. In Nauru the nominal contribution of fishing to GDP increased over the 2007–2014 period (A$1.3 million to A$1.8 million), but the published GDP increased from A$28.5 million to A$142.1 over the same period, effectively causing the percentage contribution of fishing to fall.

30.3 Contribution by Fishery Category

In this study re-estimates of fishing contribution to GDP for each country/territory were done by uniform fishery categories. These are compiled and compared in Figures 30-4 and 30-5. PNG is not shown on the figures as its nominal contributions are very large and would obscure the details for most of the small countries/territories.[1]

1 The composition of the PNG fishing contribution to GDP is given in the PNG chapter.

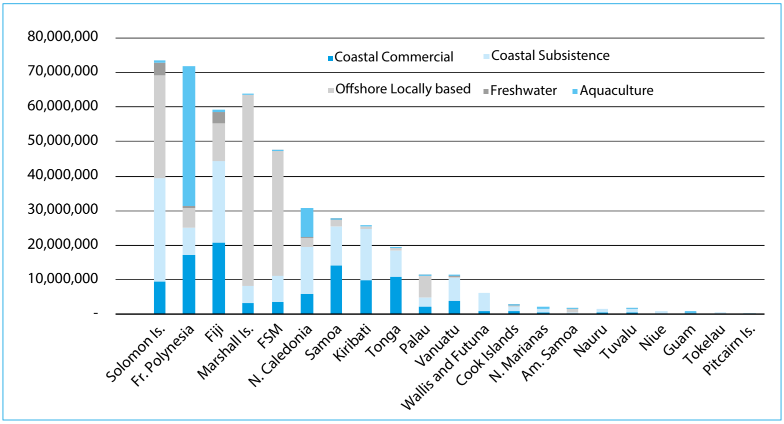


Figure 30-4: Fishing Contributions to GDP by Fishery Categories (US$)

Note: 2014 or latest year available

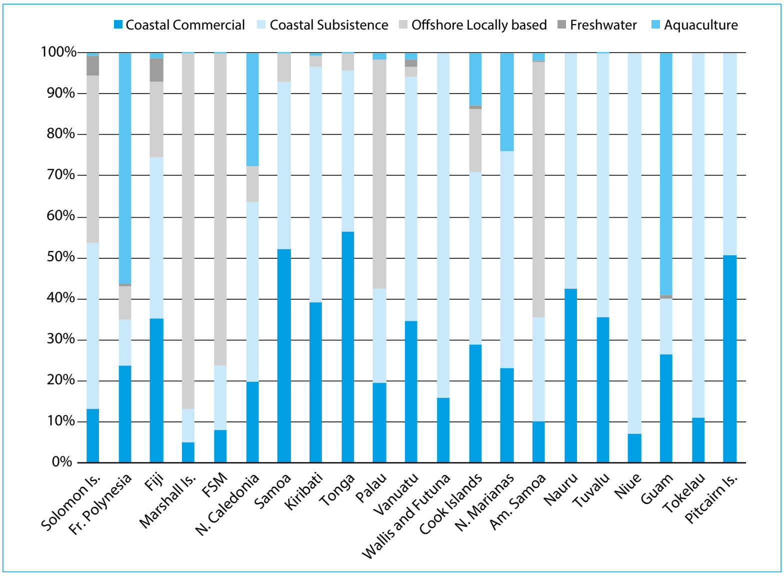


Figure 30-5: Fishing Contributions to GDP by Fishery Categories (%)

Note: 2014 or latest year available

The composition by fishery category of the overall fishing contribution to the GDP of the region is shown in Figure 30-6.

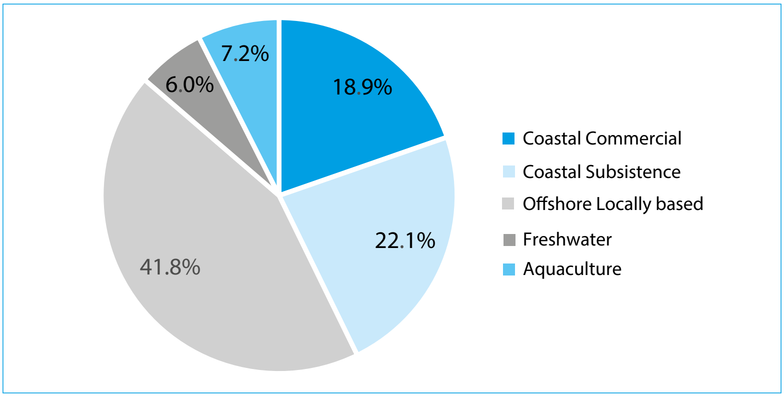
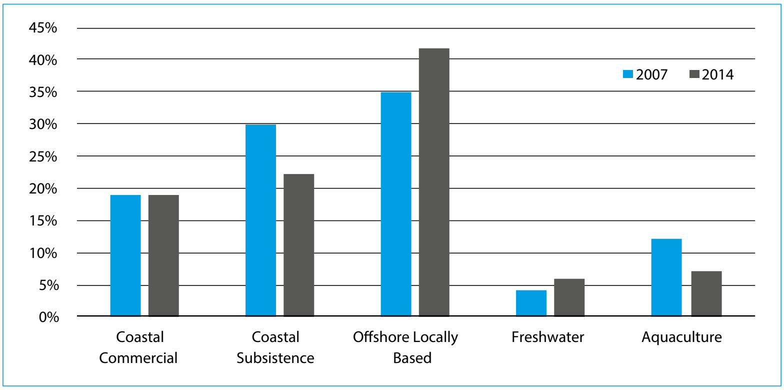


Figure 30-6: Fishing Contribution by Fishery Category to the Regional GDP in 2014

Some of the notable features of the above two figures are as follows:

- The locally based fleets in the Marshall Islands and FSM dominate the fishing contribution in these countries.
- The contributions to GDP of freshwater fisheries in the Solomon Islands and Fiji are significant – in addition to a large contribution from PNG (not shown).
- The very large contributions of aquaculture in French Polynesia and New Caledonia are apparent.
- Coastal subsistence fishing (because of its high value added ratio) assumes a greater relative importance in GDP contribution than its contribution to catch value.
- Offshore locally based fishing (because of its low value added ratio) assumes a lesser relative importance in GDP contribution than its contribution to catch value.
- The total regional contribution of aquaculture in 2014 (7.2% on the above pie chart) is smaller than its contribution in the 2009 Benefish study (12.0% in 2007) and much smaller than the contribution estimated in the Ponia (2010) study (22% in 2007).

The changes in the composition by fishery category of the fishing contribution to regional GDP over the period 2007–2014 are shown in Figure 30-7 The drop in aquaculture is mainly due to the decline in the French Polynesia pearl industry. The increase in freshwater fishing is mainly due to the use of more realistic prices in the present study for freshwater fish in PNG, by far the largest producer. The increase in offshore locally based fishing is mainly due to increased local basing of purse seiners.



Source: The present, and Gillett (2009)

Figure 30-7: Fishing Contribution by Fishery Category to Regional GDP, 2007 vs 2014

30.4 Improving the Official Estimates 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 to improve the accuracy of estimating the fishing contribution to GDP.

Statistics staff should seek technical fisheries expertise when devising methodology, collecting data, making the estimate, and reviewing the results. In addition to the government fisheries agencies, there is fisheries expertise in the private sector and the regional agencies.

Statistics staff should compare the re-estimated fishing value for their country or territory to the official estimate, and evaluate the differences and any need for modification to their current methodology.

When using the production approach for estimating the contribution of fishing to GDP the following are advised:

- Formulate logical fishery 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/territories, while the smaller countries/territories may have fewer categories.
- In the absence of specialised economic studies for the country/territory, use the suggested value added ratios given in Appendix 3 of this book.

- For estimates of offshore fishery production, use the Western and Central Pacific Fisheries Commission (WCPFC) national fishery reports. All Pacific Island countries (and some territories) prepare these for the annual meeting of the Scientific Committee of the WCPFC (available at www.wcpfc.int). Staff of the government fisheries agency or the Forum Fisheries Agency (FFA) can place values on the tonnage of fishery production in the document.

In the longer term – and at the level of the institutions supporting Pacific Island fisheries – there is some assistance that would be of considerable value at the interface between the fishing sector and national accounts. It is suggested that three issues be addressed: value added ratios (VARs), the GDP status of locally based foreign fleets, and a "satellite account" for fisheries.

More work needs to be done on the VARs, particularly for industrial-scale offshore fishing. The simplified VARs used in this and past Benefish studies were the best available at the time, but new and improved information on the finances of individual fishing companies is now 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 through time. The international standards for determining whether an entity should be included in a country's GDP were not developed with fishing in mind, and the concepts in those standards do not offer clear guidance on dealing with offshore fishing. For practical reasons and to maintain consistency with the 2001 and 2009 Benefish studies, in the present study all locally based offshore fishing operations (whether locally or foreign owned) are uniformly considered part of the economy of the country where the fishing operations are based. It is understood that in the GDP work of the FFA, locally based fleets are treated similarly. 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 possibly regional guidelines should be formulated.

There may be considerable value in developing a "satellite account" for fisheries. The international guidance for national accounts (i.e. System of National Accounts (SNA) (2008), International Standard Industrial Classification of All Industrial Activities (ISIC)) recognises the fishing sector – but the "fishing sector" does not include post-harvest activities, which are quite important in many Pacific Island countries and territories and likely to become more important in the future. To rectify this situation, a satellite account can be constructed. Within the framework of SNA, groups and subgroups 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 (several countries). A tourism satellite account is the most widespread example, with over 70 countries having compiled one. Tourism is not an industry in the SNA/ISIC categorisation, but rather an amalgamation of activities in various sectors, such as transport, retail trade, etc. By constructing a tourism satellite account, the economic contribution of tourists can 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. For illustrative purposes, in the 2009 Benefish study a crude fist-order satellite account was constructed (Box 30-1).

Box 30-1: A Satellite Account for Fisheries in Fiji

Fiji's fisheries can be defined in a variety of ways. In the absence of international the "fisheries sector" is defined as the SNA fishing sector plus the activities in the chain of custody of fish products. In national accounting terms, this would be considered a first-order satellite account. This includes:

- The value added from fishing operations (freshwater, coastal, offshore);
- Domestic marketing of the production of coastal fisheries;
- Post-harvest activities associated with export of the production of coastal fisheries, including beche-de-mer and trochus processing;
- Domestic marketing of the production of offshore fisheries; and
- Ground and air transport of the export of the production from offshore fisheries

Using the value added estimates from ADB (2005) for some of the subsectors of Fiji's fisheries sector in 2003 and making estimates of the remaining subsectors, the total value added can be estimated. Accordingly, the value added by the broad fisheries sector in Fiji in 2003 is estimated to have been about F$104,375,000. Some comments can be made on this estimate. The figure is about 34% greater than the $77.8 million that ADB (2005) estimated for the narrow SNA fishing sector. If Fiji's total GDP in 2003 was F$4,390,551,000, then the contribution of the fisheries sector to GDP increases from 1.8% to 2.3%.

Source: Gillett (2009)

31 Exports of Fishery Products

31.1 Recent Exports of Fishery Products

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 Pacific Islands Countries and Territories in 2014 (2014, unless otherwise noted)

Country/Territory	Nominal Value (local currency)	Nominal Value (US$)	% of All Exports	Additional Information
American Samoa	385,664,013	385,664,013	99.8	Data is for 2013; The fishery exports of American Samoa consist largely of canned tuna and by-products of the canneries
Cook Islands	560,000	437,500	2.6	Pearl production reached maximum production about 15 years ago when it accounted for more than 90% of exports
Fiji	114,362,000	57,758,586	9.3	From the Customs Department database
French Polynesia	10,259,000,000	104,544,991	80.0	Pearl products account for 86% of fishery exports
FSM	19,600,190	19,600,190	73.7	The Statistics Division policy is that fish should be included in exports if the company exporting is considered part of the FSM economy, so longline production is not included but purse seine production (if by a local company) is included
Guam	n/a		0	Only a small amount of fishery exports (shrimp broodstock, aquarium fish)
Kiribati	3,363,000	2,756,557	39.9	Export categories are fish, pet fish, sharkfins, seaweed, and beche-de-mer
Marshall Islands	14,600,000	14,600,000	84.4	The Marshall Islands chapter gives two other (much higher) estimates of fishery exports
Nauru	0	0	0	Informal exports of fish are made by passengers travelling on regular commercial flights, but no estimates have been made of the value
New Caledonia	2,173,000,000	22,144,095	1.5	66% of the fishery exports is cultured shrimp
Niue	115,854	90,511	0.6	The cited figure is the present study's estimate of informal fish exports as passenger baggage on flights to Auckland

Table 31-1: continuation

Country/Territory	Nominal Value (local currency)	Nominal Value (US$)	% of All Exports	Additional Information
Northern Marianas	712,500	712,500	4.5	Market shrimp and shrimp broodstock are the only fishery exports
Palau	11,500,000	11,500,000	100	If tuna exports in 2014 were $10.5 million, reef fish and giant clam exports were $0.9 million, and total exports (according to the World Bank) were $11.4 million, then fishery exports are 100% of exports
Pitcairn Islands	12,800	10,000	n/a	The only exports of fishery products are the catch that is sold to visiting vessels (cruise ships, merchant ships, yachts, and fishing vessels)
PNG	345,900,000	134,591,440	1.6	Information from the Customs Department. The national fisheries authority (NFA) maintains an independent database of the exports of fishery products, but information by commodity by year is not readily available, nor is summary information available in a recent NFA annual report
Samoa	5,562,000	2,327,197	4.7	From 1997 export bans on several types of fishery products (coral, aquarium fish, and beche-de-mer) have resulted in almost all commercial fishery exports in recent years being tuna products
Solomon Islands	418,000,000	54,783,748	11.9	Customs Department data
Tokelau	220,000	171,875	n/a	An analysis of goods shipped in 2014 from Tokelau to Samoa shows 62,867 kg of "frozen seafood"
Tonga	12,483,119	6,711,354	44.2	Exports of beche-de-mer (a very high value product) increased from 56 mt in 2013 to 143 mt in 2014
Tuvalu	36,143	29,625	100	This is an estimate by the present study as government export statistics are not detailed
Vanuatu	196,000,000	1,912,009	3.2	"Live fish" make up 72% of fishery exports
Wallis and Futuna	10,000,000	101,906	47	The only substantial fishery export in 2014 appears to be shell necklaces worn by departing tourists

Notes: Data are for 2014, unless otherwise noted. Prices are FOB. Official data are used when available. Some data irregularities are noted in the country and territory chapters.

The nominal values of fishery exports from Table 31-1, above, are shown graphically in Figure 31-1 (Nauru and Guam make no estimates for fishery exports). The data are for 2014, except for American Samoa where the data are for 2013.

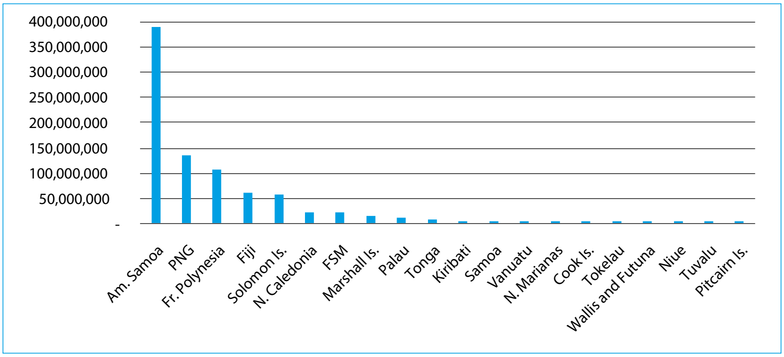


Figure 31-1: The Value of Fishery Exports from Pacific Island Countries and Territories in 2014 (2013 for American Samoa) (US$)

The relative importance of fishery exports (i.e. the value of fishery exports as a percentage of the value of all exports) is given in Figure 31-2.

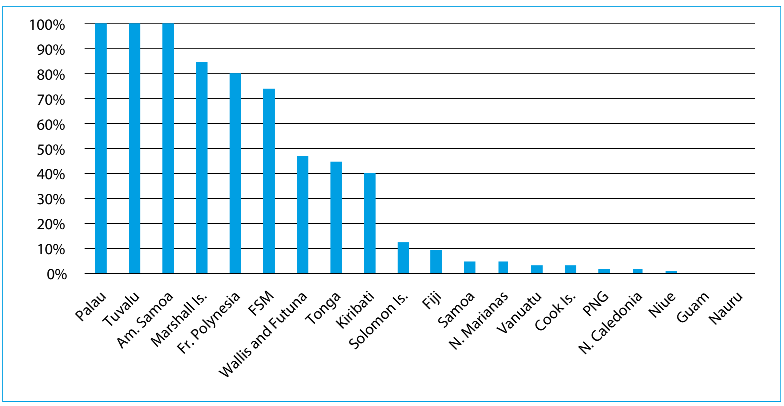


Figure 31-2 : The Relative Importance of Fishery Exports from Pacific Island Countries and Territories in 2014 (2013 for American Samoa)

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 about half of the countries/territories fishery exports represent over 40% of the value of all exports. Where they represent less than 40% of all exports, several still remain quite large in nominal terms, namely PNG

(US$136 million), Fiji (US$58 million), Solomon Islands (US$54 million), and New Caledonia (US$22 million). Other notable points evident from the table and figures are as follows:

- The three countries/territories that have the largest values of fishery exports are American Samoa, PNG, and French Polynesia. Interestingly, two of them are non-independent territories. Of the total of about US$820 million in fishery exports from the region in 2014, about 76% are from these three.
- 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 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. In other words, in these countries/territories fishery exports, although large, appear small in comparison to other exports.
- Some large exporters of fishery products are countries/territories that export only small amounts of other commodities, e.g. American Samoa, French Polynesia, FSM, and the Marshall Islands.

31.2 Changes in the Values of Exports from 2007 to 2014

The 2009 Benefish study (Gillett 2009) gave the values of fishery exports for 2007. These values are converted to 2014 prices[1] and compared to the value of fishery exports in 2014 in Table 31-2.

1 The difficulties of converting values for many different commodity types across the 22 Pacific Island countries and territories with 10 different currencies are discussed in Chapter 29. A conversion factor of 1.173 is used in this publication for converting 2007 prices to 2014 prices.

Table 31-2: Comparison of the Values of 2007 and 2014 Fishery Exports from Pacific Island Countries and Territories

Country/Territory	2007 exports (US$; 2014 prices)	2014 exports (US$)	Change in Value of Exports 2007–2014
American Samoa	514,394,939	385,664,013	-33.4%
Cook Islands	4,833,731	437,500	-1004.9%
Fiji	74,154,659	57,758,586	-28.4%
French Polynesia	150,588,931	104,544,991	-44.0%
FSM	14,429,446	19,600,190	26.4%
Guam	-	-	-
Kiribati	2,220,929	2,756,557	19.4%
Marshall Islands	43,802,166	14,600,000	-200.0%
Nauru	-	-	-
New Caledonia	184,053,138	22,144,095	-731.2%
Niue	-	90,511	-
Northern Marianas	-	712,500	-
Palau	22,287,000	11,500,000	-93.8%
Pitcairn Islands	44,037	10,000	-340.4%
PNG	118,473,000	134,591,440	12.0%
Samoa	8,954,682	2,327,197	-284.8%
Solomon Islands	23,207,372	54,783,748	57.6%
Tokelau	-	171,875	-
Tonga	5,702,868	6,711,354	15.0%
Tuvalu	4,945	29,625	83.3%
Vanuatu	1,443,012	1,912,009	24.5%
Wallis and Futuna	91,683	101,906	10.0%
Total	**1,168,686,538**	**820,448,097**	**-42.4%**

The changes in the values of fishery exports from 2007 to 2014 are shown in the following two figures, where the countries/territories are separated into two groups – large exporters and small exporters.

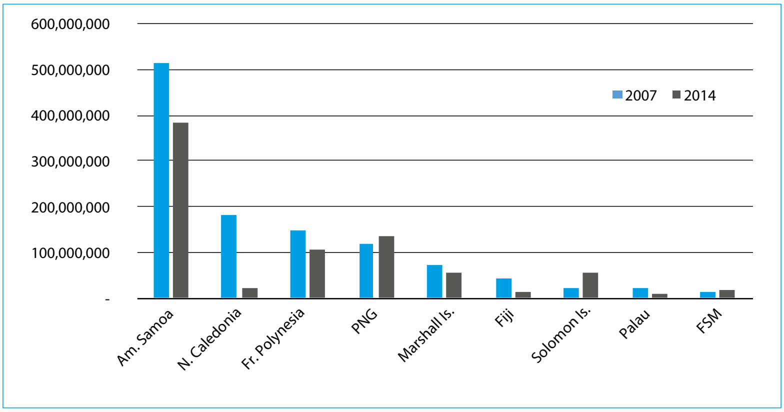


Figure 31-3: Changes in Value of Fishery Exports 2007–2014 for the Large Exporters (US$, 2014 prices)

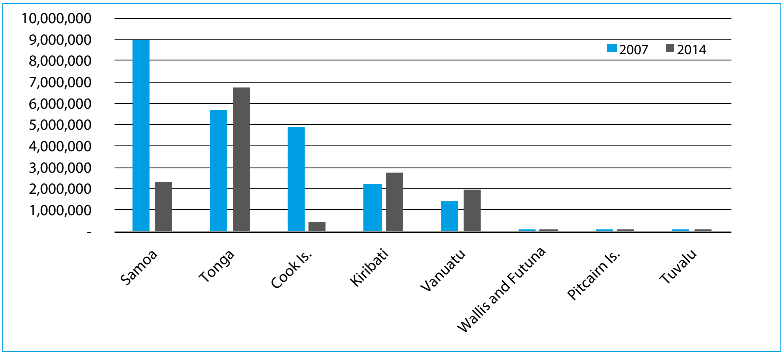


Figure 31-4: Changes in Value of Fishery Exports 2007–2014 for the Small Exporters (US$, 2014 prices)

From the table and figures above several observations can be made on changes of the values of fishery exports over the period 2007–2014:

- The total amount of fishery exports from the entire region fell about 42% in real value over the period.
- The fall in the value of canned tuna exports from American Samoa was responsible for about 37% of the total regional decline.
- The fall in exports from American Samoa, French Polynesia, and New Caledonia combined was responsible for about 97% of the total regional decline.
- The total amount of fishery exports from the independent countries of the region fell about 4% in real value over the period.

- Of the large exporters, only PNG and Solomon Islands scored gains over the period.
- Some of the biggest falls (French Polynesia, Cook Islands) were due to declines in the pearl industry.

31.3 Issues in Measuring Fishery Exports

In the course of collecting and compiling information on fishery exports, some observations were made on the accuracy of the data. The most notable feature 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 (e.g. FSM and the Marshall Islands) and estimate fishery exports through indirect methods. Keeping track of fishery exports, compared to other major commodities exported by Pacific Island countries and territories, is more complex due to many exporters, a multitude of different products each with different values, large numbers of small shipments, and many different export points. Often there is no examination by customs departments of the exported commodities.

In about half of the Pacific Island countries and territories 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), as 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 most countries it is very difficult to actually obtain the data or data summaries from the staff of the fisheries agencies[2], 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 Harmonised Commodity Description and Coding System (HS)[3] 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: the trade statistics show that in 2014 F$251,476 of "Other fish excluding livers and roes" were exported – a category that could include products from offshore and/or coastal fisheries.

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 lump other fishery products together with miscellaneous non-fishery commodities.

There are some inconsistencies in the export treatment of tuna transshipments. Some agencies do not consider that transshipments in a country are exports of that country (e.g. Tuvalu's Central Statistics Division). Some agencies consider that only those transshipments made by companies that

2 In two of the countries of the present study, after obtaining agreement in principle to obtain fisheries agency export information, multiple requests over a 3-month period did not produce reasonable export data.

3 Harmonised Commodity Description and Coding System (Harmonised 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.

are considered part of the domestic economy are exports of the country (e.g. FSM's Statistics Division). Within a single country different national or international agencies sometimes treat transshipments differently, and hence have very different estimates of total exports (e.g. the three estimates of the 2014 fishery exports of Marshall Islands are: $14.6 million vs $44.8 million vs $121.2 million).

According to officials of the International Monetary Fund (G. Legoff, per. com. August 2015), changes in the System of National Accounts (SNA) may affect the classification of some of the fishery exports of the region. In the newest version of SNA (issued in 2008) fish sent to one country for processing and subsequent re-export are no longer considered an export of the processing country.

32 Government Revenue from Fisheries

32.1 Access Fees for Foreign Fishing

In the country and territory chapters, information is provided on access fees received for foreign fishing. Table 32-1 summarises the fees paid in 2014 (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 (countries/territories are included where access fees and other revenue are collected and data is available, throughout this chapter).

Table 32-1: Access Fees for Foreign Fishing in 2014

Country/ Territory	Access Fees (local currency)	Access Fees (US$)	Access fees as % of Government Revenue	Other Information
Cook Is.	10,800,000	8,437,500	11.4%	Access fees for FY 2014/2015
FSM	47,518,000	47,518,000	20.9%	The fees are those actually collected (from government audits)
Fiji	1,100,513	555,815	0.04%	The only access fees since 2006 are from the US Tuna Treaty
Kiribati	141,570,000	116,040,984	75%	Information from the Ministry of Finance and Economic Development Annual Report 2014
Marshall Is.	16,920,802	16,920,802	16.4%	
Nauru	19,340,000	15,852,459	13.7%	By FY for fees and total revenue
Niue	813,843	635,815	3.3%	For FY 2013/2014
Palau	3,620,586	3,620,586	3.3%	Access fees from government audit
PNG	218,500,000	85,019,455	1.7%	Access fees estimated
Samoa	1,328,395	555,814	0.3%	The only access fees are from the US Tuna Treaty
Solomon Is.	213,361,944	27,963,558	7.2%	
Tonga	1,167,816	627,858	0.4%	Access fees for 2014; government revenue for FY 2013/2014
Tuvalu	18,028,933	14,777,814	58.3%	
Vanuatu	180,326,546	1,759,112	1.0%	
American Samoa	0			No authorised foreign fishing in the zone
French Polynesia	0			No authorised foreign fishing in the zone
Guam	0			No authorised foreign fishing in the zone
New Caledonia	0			No authorised foreign fishing in the zone
Northern Marianas	0			No authorised foreign fishing in the zone
Pitcairn Islands	0			No authorised foreign fishing in the zone
Tokelau	11,584,000	9,050,000	52.6%	
Wallis and Futuna	0			No authorised foreign fishing in the zone

Source: Country and territory chapters of this book

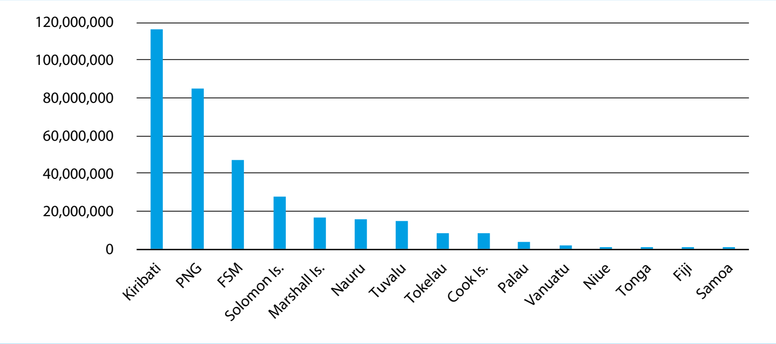


Figure 32-1: Access Fees for Foreign Fishing in 2014 (US$)

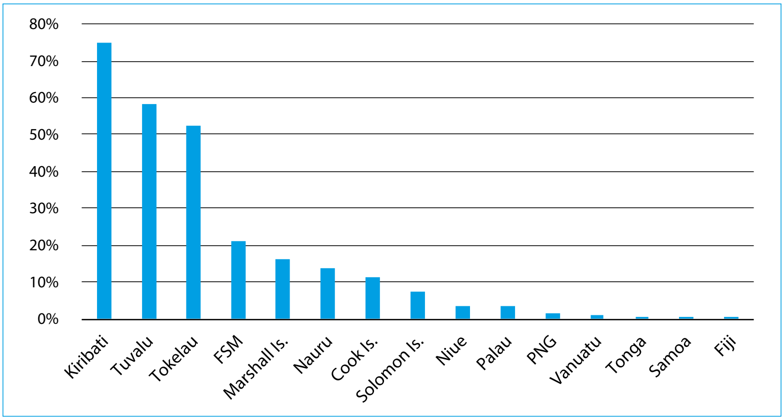


Figure 32-2: Access Fees for Foreign Fishing in 2014 as a Percentage of Total Government Revenue (%)

There are several caveats and explanations relating to the information in the table and figures:

- Some Pacific Island countries consider that all payments under the US Tuna Treaty are for fishing access, while others treat some components as aid. Unless otherwise stated in a government document, all US tuna treaty payments are assumed to be for access.
- In countries that receive money and also "goods and services" from foreign fishing entities in exchange for access, the above table and figures consider only the money portion.
- The exchange rates used are the average-of-year rates given in the *Currency Equivalents* section in the preliminary pages of this book and at the end of each country/territory chapter.

- 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). 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 and territory chapters.
- The access fees are mostly taken from government fishery agency documents and/or government finance agency documents in the public domain. In one case (PNG) they were estimated using information from several sources.

For the year 2014 foreign fishing access generated a total of US$349,335,572 for the 22 Pacific Island countries and territories. Because there is no authorised foreign fishing in most territories, this figure equates to the independent Pacific Island countries plus Tokelau.

The information on 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, 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 reducing since a similar collection of fee information was carried out in 2008 by an earlier Benefish study (Gillett 2009). This could be due to periodic formal reconciliations of fees, for example, the report "Fishing License Revenues in Kiribati" by the Ministry of Finance and Economic Development and the Ministry of Fisheries and Marine Resource Development.

Another change since 2009 is that there appears to be a tendency for fisheries agencies in some countries to be more secretive about access fees received, with the idea that total transparency would be harmful to their bargaining position in transactions under the PNA Vessel Day Scheme. In most countries where that occurred the secrecy did not extend to the government finance agency.

Table 32-2: uses the access fees from Table 32-1 to make some comparisons.

Table 32-2: Access Fees: Some Comparisons

Country/ Territory	2014 Access Fees (US$)	2014 Access Fees as a % of the Value of Foreign-based Offshore Fishing	2014 Access Fees per Resident (US$)	2014 Access Fees per km² of 200-mile Zone (US$)	Other Information
Cook Islands	8,437,500	14.8%	554	4.61	
FSM	47,518,000	20.8%	462	5.96	
Fiji	555,815	Large	1	0.43	No foreign fishing in zone, but payments under the US tuna treaty
Kiribati	116,040,984	10.4%	1,044	32.69	
Marshall Islands	16,920,802	43.7%	310	7.94	Access fees as a % of foreign-based offshore fishing distorted by fee-paying locally based foreign fleet
Nauru	15,852,459	6.9%	1,487	49.54	
Niue	635,815	41.8%	424	1.63	Access fees as a % of foreign-based offshore fishing distorted by US Tuna Treaty payments for no fishing
Palau	3,620,586	19.5%	203	5.76	
PNG	85,019,455	27.3%	11	27.25	
Samoa	555,814	Large	3	4.63	No foreign fishing in zone
Solomon Islands	27,963,558	35.3%	45	20.87	
Tokelau	9,050,000	27.3%	7,762	31.21	
Tonga	627,858	12.4%	6	0.90	
Tuvalu	14,777,814	11.2%	1,321	16.42	
Vanuatu	1,759,112	6.7%	6	2.59	
Total	349,335,570	15.4%	32	11.43	

Source: Table 32-1 and other sections of this book

One of the columns in Table 32-2 requires further explanation: 2014 access fees as a percentage of the value of foreign-based offshore fishing[1]. This is a crude attempt to estimate the fraction of the value of fish harvested by foreign fishers that is received by countries through access fees. A difficulty occurs because in some countries (e.g. the Marshall Islands) there are fee-paying foreign locally based fleets that inflate the percentages in the column. Another difficulty is that when there are payments for fishing that does not

1 The "value of foreign-based fishing" comes from estimates of foreign-based offshore fishing in the country and territory chapters. Rather than "landed values", these values are the "in-zone" values (i.e. destination market values adjusted for cost of transport to those markets) – something closer to the real economic value to the countries where the catch was made.

take place (e.g. under the US tuna treaty) a very large percentage is created. This features dominates the results in Fiji and Samoa and has a large effect in Niue. The information in that column should therefore be used cautiously.

The results from the table (excluding the outliers: Fiji, Marshall Islands, Niue and Samoa) are shown graphically in the following three figures.

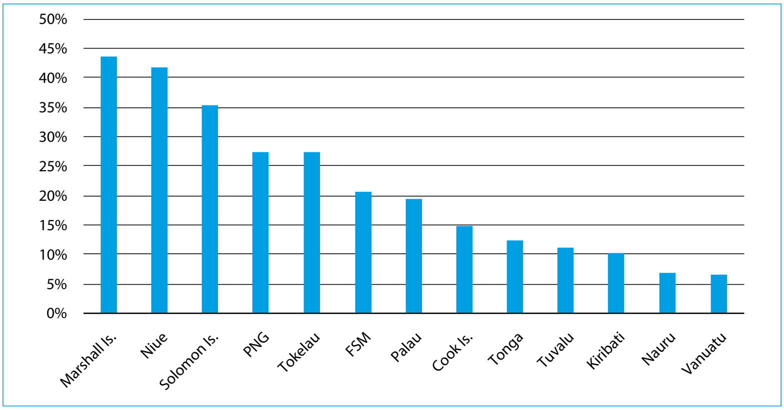


Figure 32-3: 2014 Access Fees as a Percentage of the Value of Foreign-Based Offshore Production

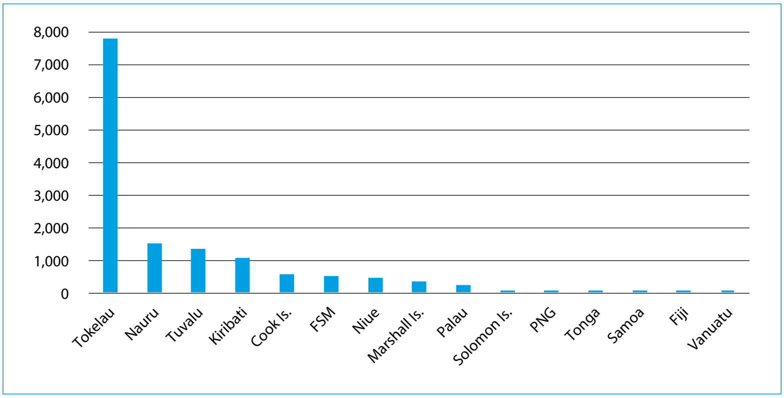


Figure 32-4: 2014 Access Fees per Resident (US$)

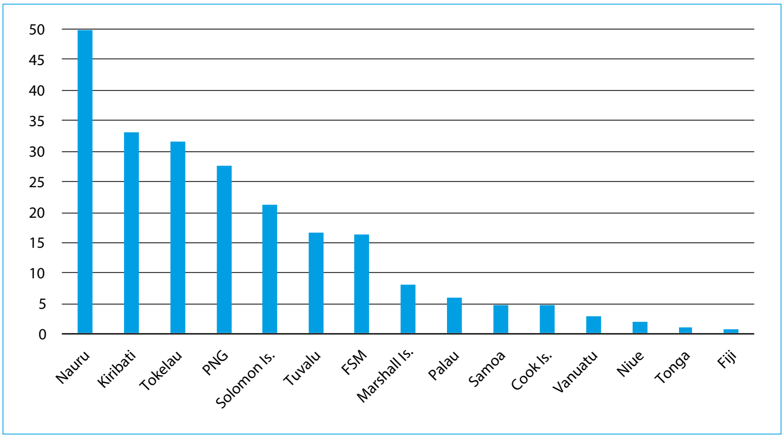


Figure 32-5: 2014 Access Fees per km^2 of 200-mile Zone (US$)

The comparisons above between access fees and other features (catch values, number of residents and size of zones) represent just one data point for each country (e.g. comparing one year's access fees with one year's catch value). 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 is does exist, it is given in the country and territory chapters and available for further analysis by interested parties.

In Chapter 30 it is stated: "Three countries in an area of relatively good tuna fishing had no locally based offshore fishery production: Nauru, Tuvalu, and Tokelau. A fourth country, Kiribati, had just a tiny amount of locally based offshore fishery production." It is interesting to note that these four countries are the same ones that had the highest access fees per resident.

Some other obervations on the above table and figures are as follows:

- Four countries of the region received in 2014 access fees that equated to more than US$1,000 per capita.
- Kiribati, despite having one of the largest 200-mile zones in the region, had relatively high access fees per km2 of zone in 2014.
- Some countries (e.g. FSM) have domestication policies in place and are not primarily focusing on maximising access fees, hence their relatively low position in some of the graphs.

Access fees were collected in a similar way during the earlier Benefish study (Gillett 2009), with the target year being 2007. The 2007 access fees were converted to 2014 prices[2] and are compared to 2014 access fees in Table 32-3 and Figure 32-6.

Table 32-3: Changes in Access Fees 2007–2014

	2007 Access Fees (in 2007 US$)	2007 Access Fees (in 2014 US$)	2014 Access Fees (US$)	% Change 2007–2014
Cook Islands	262,000	307,326	8,437,500	2,645%
FSM	14,757,221	17,310,220	47,518,000	175%
Fiji	256,985	301,443	555,815	84%
Kiribati	21,361,214	25,056,704	116,040,984	363%
Marshall Islands	1,953,644	2,291,624	16,920,802	638%
Nauru	5,147,899	6,038,486	15,852,459	163%
Niue	263,983	309,652	635,815	105%
Palau	1,121,281	1,315,263	3,620,586	175%
PNG	14,966,216	17,555,371	85,019,455	384%
Samoa	256,985	301,443	555,814	84%
Solomon Islands	11,764,705	13,799,999	27,963,558	103%
Tokelau	1,478,676	1,734,487	9,050,000	422%
Tonga	132,206	155,078	627,858	305%
Tuvalu	3,445,378	4,041,428	14,777,814	266%
Vanuatu	1,359,700	1,594,928	1,759,112	10%
Total	**78,528,093**	**92,113,452**	**349,335,572**	**279%**

Source: Gillett (2009) for 2007, and Table 32-2 for 2014 fees

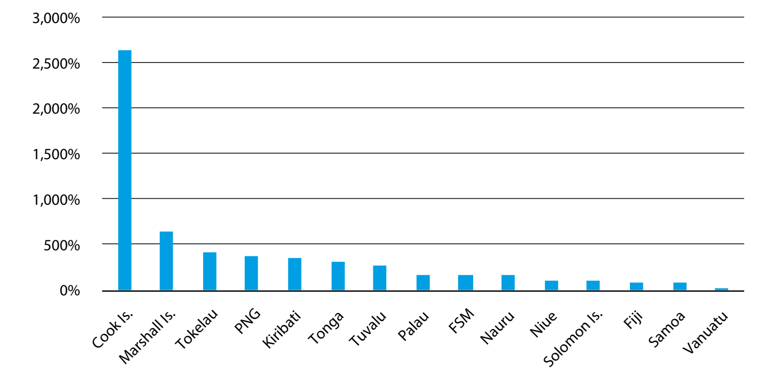


Figure 32-6: Percentage Increase in Access Fees 2007–2014

2 The difficulties of converting values for the many different commodity types across the 22 Pacific Island countries and territories with their 10 currencies are discussed in Chapter 30. In short, a blanket conversion factor of 1.173 is used in this publication for converting 2007 prices to 2014 prices.

From the above table and figure the following are evident:

- In the period 2007–2014 access fees increased in all countries that receive access fees.
- The countries that had the largest increase in access fees were those that participate in the Vessel Day Scheme.
- The huge increase in access fees in the Cook Islands was from a very low level in 2007.

Historical access fees for the region are readily available in the public domain for only a limited number of years. These are:

- 2014: US$349 million (this study)
- 2007: US$78.5 million (Gillett 2009)
- 1999: US$60.3 million (Gillett et al. 2001)
- 1996 US$66.3 million (Gillett 1997)
- 1982: US$15 million (Clark 1983).

Bearing in mind that these amounts are nominal access fees (i.e. they are not converted to 2014 prices), the evolution in the level of the fees is shown in Figure 33-7. As a crude indicator of the real change in access fees, the $15 million received by countries in 1982, if adjusted by the CPI for the USA, could be considered equivalent to about $36.8 in 2014 prices – which equates to a 848% increase in value over the 1982–2014 period.

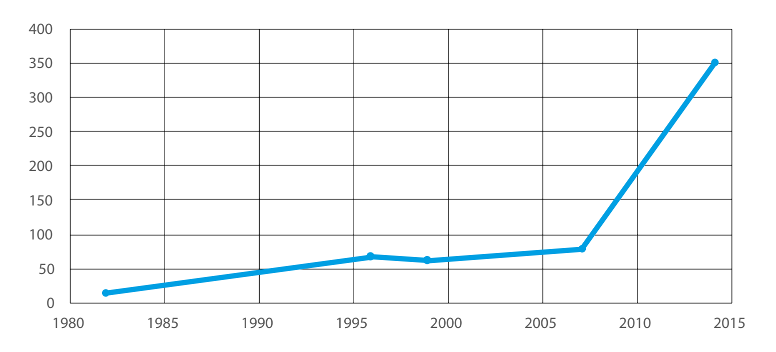


Figure 32-7: Change in Access Fees 1982–2014 (US$ millions)

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 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.

Another aspect is how the change in access fees relates to the El Niño shift in production. The focus year for the last Benefish study, 2007, was not an El Niño year (it was a weak La Niña) while 2014 was a weak El Niño year.

Table 32-4: Changes in Access Fees with Changes in Areas of Production

Offshore catches		
	PNG and FSM	Kiribati, Tuvalu, Tokelau, and the Cook Islands
2007	57%	22%
2014	28%	49%
Access fees		
	PNG and FSM	Kiribati, Tuvalu, Tokelau, and the Cook Islands
2007	38%	34%
2014	40%	42%

Source: FFA (2015) for catch information, Table 32-3 for access fees

In the above table it can be seen that over the period 2007–2014 the relative production decreased markedly in the west and increased markedly in the east – as expected in an El Niño shift. The access fees, however, did not show a similar shift.

The lack of shifting of revenue appears to be a feature of the PNA Vessel Day Scheme. In the VDS overall limits are set by PNA on the number of days that purse seine fishing vessels are allowed to fish in PNA waters. Vessel days are allocated to each country. Under the scheme revenue is largely related to the distribution of vessel days among countries and (except for vessel days that are traded or pooled) not the distribution of fishing. This has the effect of reducing fluctuations of government revenue from access fees – one of the objectives of having such a scheme (L. Clark and G. Preston, per. com. February 2016).

32.2 Other Government Revenue from Fisheries

In each country/territory chapter there is a section providing the readily available information related to government revenue generated from the fisheries sector that is not related to foreign fishing access fees. This information is summarised in Table 32-5.

Table 32-5: Government Revenue from Fisheries Other than Foreign Access Fees

	Other Government Revenue from Fisheries
Cook Islands	Revenue from licensing Cook Islands flagged offshore fishing vessels is not readily available, but was around NZ$566,000 annually in recent years. In FY 2014/2015 there were fines of NZ$1.3 million for out-of-court settlements for fisheries infringements.
FSM	National Oceanic Resource Management Authority (NORMA) annual reports do not provide information on government revenue, other than fishing access fees. In FSM much of the non-access government revenue from the fisheries sector is acquired at the state level. For example, Pohnpei State government received from the fisheries sector in FY 2014: • Water bunkering: US$179,126 (mostly for fishing vessels) • Transshipment: US$117,721 (for the period March–September 2013) • Commission on ice sales: US$197
Fiji	The major fees for the locally based offshore fleet are the access fee, management fee, and observer levy. These fees amounted to F$$844,000 in 2013 and F$701,000 in 2014. The Fisheries Department also charges for a variety of permits: landing permit, transshipment, export, high seas, bycatch, import, and CITES.
Kiribati	Unpublished data from the Ministry of Finance and Economic Development show all fisheries-related revenue in 2014: vessel and equipment hire (A$3,254.50), fish and fish poster sales (A$30,680.25), local fishing (A$69,377.85), local licensing (A$41,611.40), and fish transshipment fees (A$963,591.07).
Marshall Islands	The Marshall Islands Marine Resources Authority (MIMRA) annual reports and unpublished data give non-access revenue received by the government from fishing activities: transshipment fees (US$547,000), fishing violation fines (US$825,000), observer fees (US$561,924), and other fees (US$146,523); total US$2,082,461.
Nauru	Information is not readily available on Nauru Government revenue from fisheries that is not associated with access by foreign fishing vessels.
Niue	No information is available on the amount of such revenue in Niue, if any.
Palau	During the period 1999 to 2007 there was a tax of US$0.25 per kg of fish landed by longliners in Palau. In addition, the government also charges fees for several activities related to fisheries. These include the Marine Export Declaration Fee: citizen (US$5 per permit), non-citizen (US$10), commercial (US$25), scientific research (US$25). There are also charges for CITES permits: non-commercial (US$5), commercial (US$25), scientific research (US$25).
PNG	The tuna sector generates revenue from application fees, observer fees, and training levies. A substantial amount of tuna transshipment occurs in PNG; PNG does not charge transshipment fees, but harbour fees and cost recovery of monitoring services are applied.

Table 32-5: continuation

	Other Government Revenue from Fisheries
Samoa	The other major source of government revenue from fisheries is from licensing of domestic fishing vessels. In FY 2013/2014 ST$89,400 was collected from the 64 longliners based in Samoa. The fees range from ST$200 for vessels under 11 m to ST$10,000 for vessels over 20.5 m. The government also receives money from licensing fish processing establishments (ST$1,050 per licence), export certificates (ST$5–10 per certificate; ST$$2,279 collected during the FY), market table renting (ST$10 per day), ice, and transshipment (ST$0.10 per kg).
Solomon Islands	The non-access government revenue from the fisheries sector in 2014 was: local fisheries licence fees (SI$144,228.32), export permit fees (SI$234,837.95), fish processing licence fees (SI$479,173.34), port entry fees (SI$47,800.00), fish and miscellaneous sales (SI$635,100.00), transshipment levies (SI$1,095,033.87), observer and services fees (SI$550,221.40); total SI$3,186,394.88.
Tonga	In FY 2014 the non-access revenue from the fisheries sector was: consumption tax collected on sales by the fisheries division (T$68,229), fish bond (T$1,700), sales of produce (T$580), domestic licences, (T$235,290), fees (admin, export taxes, sales of illegal fish, etc.) (T$198,347), other sales (T$44,240); total T$548,386.
Tuvalu	In addition to the access fees, the Government of Tuvalu receives substantial money from its participation in joint venture fishing arrangements and from tuna transshipment. Smaller amounts come from observer levies, chartering boats, and filling scuba tanks. Some of the island councils charge for various permits relating to fishing and selling fish. Transshipment fees are currently set at US$3 per tonne for cannery grade fish and US$10 per tonne for sashimi grade fish; 43 transshipments occurred in 2014.
Vanuatu	Other government revenue consists primarily of authorisations to fish (VT128.6 million in 2014) and domestic licences (VT 28 million in 2014).
American Samoa	The Department of Marine and Wildlife Resources issues about ten fishing licences per month at a cost of US$10 per licence, amounting to revenue of about US$1,200 per year. The revenue is deposited in the general fund of the Government of American Samoa.
French Polynesia	There is a small tax on the export of pearls. In 2009 this tax was changed from XPF 200 per gram to XPF 50 per pearl. In 2010 a total of XPF 493 million was collected. In general, in French Polynesia the fisheries sector is not revenue generating, but rather subsidy absorbing.
Guam	Any fishing licensing fees paid by vessels based in Guam go to US government agencies rather than to the Government of Guam.
New Caledonia	In general, in New Caledonia the fisheries sector is not revenue generating, but rather subsidy absorbing.
Northern Marianas	There are no requirements for commercial fishing vessel, operator, or crew licences for inshore or offshore waters.
Pitcairn Islands	No information is available on non-access forms of government revenue from the fisheries sector.
Tokelau	The island administrations do not tax or license fishing activity.
Wallis and Futuna	In Wallis and Futuna the fishing sector is not revenue generating, but rather subsidy absorbing.

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 licence 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 division).

Fees for transshipment are only given in the table for four countries, but it is likely that with additional research the amount of money paid in each country 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 at advertising its importance. In the tourism sector, for example, it is likely that a benefit of a magnitude similar to that from transhipping would be publicised with enthusiasm.

Some of the benefits of transhipping in the region are highlighted by McCoy (2012):

> The total estimated PIC direct revenue from purse seine transshipment fees in 2010 was approximately $1.45 million. Transshipment in Majuro generated 33% of total transshipment fees, Honiara 25%, Pohnpei 24%, and Tarawa 18%. PNG does not charge transshipment fees. Private sector gross revenue from sales of goods and services to purse seiners engaged in transshipment ranges from a high of $4,000—$8,000 per transshipment in Majuro to a low of $1,000—$2,000 in Tarawa. Total gross revenue for PIC governments and the private sector per purse seine transshipment ranges from a high of $9,500—$14,500 in Majuro to a low of $2,600—$6,700 in Rabaul.

Some of the additional features of the non-access government revenue from the fisheries sector are as follows:

- 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).
- Apart from any company or personal taxation, no Pacific Island territory receives significant non-access revenue and only Tokelau received access revenue.
- Two countries (Solomon Islands and Tonga) have export duties on fishery products – which apparently were imposed to prevent unfair transfer pricing by vertically integrated fishing/marketing companies.

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 involvement in fisheries at the national level relative to other occupations. The chapter also examines the distribution of this involvement with respect to gender and age. Employment is an important benefit from fisheries and it needs to be better quantified so that the sector's contribution can be fully appreciated. Further, 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.

The employment information presented in the country and territory chapters is a heterogeneous collection of various types of data. Meaningful summaries of the fisheries-related employment situation at the national level and inter-country 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 originate from studies ranging from initiatives confined to the fisheries sector to much broader exercises that cover all economic sectors or the entire population, e.g. 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.

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.

- There is inconsistency across countries/territories in the categorisation of 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 and could be selective and/or self-serving.

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 (a) employment in commercial fisheries, and (b) involvement in subsistence fishing. This exercise was also carried out in the previous Benefish study (Gillett 2009) 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 and territory chapters.

Table 33-1: The Importance of Fisheries-Related Employment (Commercial and Subsistence) in Pacific Island Countries and Territories

Country/ Territory	Recent Information on Fisheries-Related Employment, and Corresponding Information from the Previous Benefish Study (in bold italics)
Cook Islands	The 2011 census indicated that 42.4% of households in 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. ***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 1 to 2 fishers. A similar SPC survey on Rarotonga shows that less than half of all households (44%) are engaged in fisheries with an average of one fisher per every second household only.***
FSM	The 2013/2014 HIES has some fisheries-related employment information: • 1.8% of total wage and salary income comes from fishing • 12.9% of households are involved with subsistence fishing • The net monthly value from subsistence fishing is $18 per household ***In 2007 the "number of 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.***

Country/ Territory	Recent Information on Fisheries-Related Employment, and Corresponding Information from the Previous Benefish Study (in bold italics)
Fiji	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. ***Combining information in 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) represent about 3.8 percent 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 2010 census gives the major categories of fisheries jobs broken down by age and sex of the workers. It gives a total of 3,178 employed in seven fisheries categories; on examination, the data seem to underestimate the numbers of workers in some types of jobs. ***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-related 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.***
Marshall Islands	In the 2008 employment survey, 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. The report of the 2011 census states that a total of 3,787 households reported fishing – that is, 48.9% of all households. Of these, 64.1% claimed it was for subsistence purposes, 34.8% claimed that fishing was for both subsistence and income, and 1.1% reported it as a means of income only. ***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 2011 census indicated that the main source of household income was: for 85% of all households, wages and/or salary; for 7% of households, 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 between Nauru's 14 districts. The results of the 2012/2013 HIES indicated that 26% of households were engaged in fishing. About 8.94% of the Nauruan labour force of 3,952 were involved in some form of fishing; this equates to about 353 fishers. With regards to full-time fishers, if "full-time" means those who have fishing as their main activity, the figure is 1.26% of the Nauruan labour force or about 50 fishers. ***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.***
Niue	The 2009 agriculture census of Niue indicated that most households were engaged in inshore fishing (62%), 31% were involved in both inshore and offshore fishing, with the remaining 7% being involved in offshore fishing only. The main purpose of household fishing was for home consumption, accounting for 82% of fishing households, with 16% selling some of their catch and the remaining 2% selling most or all. ***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.***

Country/ Territory	Recent Information on Fisheries-Related Employment, and Corresponding Information from the Previous Benefish Study (in bold italics)
Palau	The Fiscal Year 2014 Statistical Appendices have information on employment in Palau obtained through social security and tax records. This shows the number of fishing workers to be 83 out of a total number of workers in Palau of 10,386, meaning fishing workers are 0.8% of all workers. ***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.***
PNG	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. ***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 there are in PNG about 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 fresh water fishing).***
Samoa	A 2012 socio-economic fisheries survey found that fishing was third to agriculture and paid salary in terms of income source. Overall, 14% of all households ranked fishing as their first source of household income; the figure 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. ***Formal registered employment in 2007 consisted of 22,150 people, of which 196 people (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.***
Solomon Islands	There were two recent national censuses: 1999 and 2009. The report of the 2009 census gives "changes in paid employment" in the ten-year period between the two surveys: (a) 1999: total jobs in fishing 3,367 (2,935 males and 432 females); (b) 2009: total jobs in fishing 5,736 (5,076 males and 660 females). The changes during the period were 70.4% increase in paid employment in fishing (72.9% increase for males and 52.8% increase for females). An ADB study in 2010 stated that the number of subsistence fishers in Solomon Islands could 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. ***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.***

Country/ Territory	Recent Information on Fisheries-Related Employment, and Corresponding Information from the Previous Benefish Study (in bold italics)
Tonga	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 their own consumption. Overall, 2.0% of the population was involved with fishing. Participation in fishing was highest in the 40–44 and 45–49 year classes. ***The 2003 survey of employment indicated that there were 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 or 12.8% of the country's population in 2003.***
Tuvalu	The 2012 census showed that 75.3% of the sampled households participated in some kind of fishing. Overall 9.2% of households in Tuvalu received income from fish sales: 7.2% on Funafuti and 11.0% on 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. A total of 436 households in Tuvalu (24.7%) were not involved in any kind of fishing activities. Of these households, 301 were on Funafuti and 135 were on the outer islands. ***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 only for "own/family use", 2% for only sale, and 18% for mixed subsistence/commercial.***
Vanuatu	The Vanuatu Socio-Economic Atlas uses information from both the 2009 census and the 2010 HIES. It shows the percentage of households that are involved in any fishing activity by province: Torba (76.8%), Sanma (48.7%), Penama (36.1%), Malampa (46.1%), Shefa (43.3%), Tafea (43.1%), Port Vila (9.6%) and Luganville (17.6%); the percentage of households that reported sale of fish/crops/handicrafts as a main source of income: Torba (61.2%), Sanma (67.3%), Penama (67.9%), Malampa (60.0%), Shefa (46.1%), Tafea (60.2%), Port Vila (2.2%) and Luganville (4.4%); and areas with especially high involvement in fishing: Northwest Santo, South Maewo, South Malekula, North Erromongo, South Erromongo, and Aneityum. The Vanuatu 2010 HIES found that more than 75% of the adult population practises 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.***

Country/ Territory	Recent Information on Fisheries-Related Employment, and Corresponding Information from the Previous Benefish Study (in bold italics)
American Samoa	In 2013 (the latest year for which employment data are available) 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 ten 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 with 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 is not readily available.***
French Polynesia	A 2015 review of labour in French Polynesia stated that the pearl workforce consisted of 1,060 employees in 2014. A 2014 study of the pearl industry stated 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. ***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. 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	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; none were reported to be held by women. ***A study in 2008 stated that the Guam Fishermen's Cooperative membership includes 164 full-time and part-time fishermen (0.1 percent of Guam's population) and it processes and markets an estimated 80 percent of the local commercial catch. With respect to subsistence fishing, a 2007 household survey of 400 local residents showed approximately 40 percent 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.***
New Caledonia	A 2015 report gave information on registered commercial fishers in 2010: 613 in coastal fishing and 120 in offshore fishing. A 2014 report from the government fisheries agency updated the information on employment in offshore fishing. It estimated that in 2013 there were 120 onboard crew, 30 people in onshore vessel management, 60 people in processing, and 20 people in fish wholesaling – a total of 230 people. ***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 Marianas	An NGO-sponsored study in 2011 stated that more than 50 professional fishers are estimated to work for formal businesses, while the number of independent and semi-subsistence fishers remained unknown. The CNMI Prevailing Wage & Workforce Assessment Study indicated that of the 25,658 people employed in 2014, 425 were employed in "farming fishing and forestry". No further disaggregation is given. ***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 twenty percent of all the people interviewed are active fishermen and go fishing once every week or two.***

Country/ Territory	Recent Information on Fisheries-Related Employment, and Corresponding Information from the Previous Benefish Study (in bold italics)
Pitcairn Islands	• An SPC (2011) report states: "There are no full-time fishers, but there are eight part-time commercial fishers, seven men and one woman". Another SPC (2011) report states: "In addition to the eight commercial fishers, there are about 15 non-commercial fishers". ***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. 12 people equate to about 19% of the island's population.***
Tokelau	The report of the 2011 census disaggregated the employment data only 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 50–59 years had the highest proportion of people who helped with village fishing (44.8%). ***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	A report in 2015 by the government statistics agency estimated that there are about 40 professional fishers (i.e. full-time commercial fishers). It also estimated that one in three households does some kind of fishing. Another 2015 report stated that the rate of participation in fishing is 39.3% in Futuna and 28.6% in Wallis. ***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".***

Source: Employment sections of the country and territory chapters of this book

There is much conflicting information in the table. For example, in Nauru the difference in results between the 2011 census and the 2012/2013 HIES is quite large. The census indicated that just over half (51%) of all households in Nauru were engaged in fishing activities, while the HIES estimated that 26% of households were engaged in fishing.

Other notable features of the employment/participation information in the table and in the country/territory chapters are as follows:

- In several of the countries/territories, in the more general surveys (e.g. census, HIES) fisheries-related employment is reported in an aggregate category that is not very useful for fisheries purposes. Examples include "Skilled agricultural forestry and fishery workers" (Niue), "farming, forestry, and fishing" (Palau), and "Labourers, agriculture, and fisheries workers" (Tokelau).
- Some of the definitions seem somewhat inappropriate for the fisheries sector and have the potential to disadvantage the sector relative to other sectors. As an example, the Palau census defines participation in subsistence activities as "he/she mainly produced goods for his/her own or family's use and needs". When applied to fisheries, this defines a group

that is a small subset of all people involved in subsistence fishing. (i.e. many people are involved in cash employment and subsistence fisheries – and this would not be defined as participation in subsistence fishing.

- Some of the fisheries-related employment information, especially that produced by surveys that are not fisheries focused, is counter-intuitive or just wrong. As an example, in the Kiribati 2010 census it states that 122 people were employed in the category "deepsea fisherman", a term that is not defined in the census report. If this refers to fishing in the open ocean from skiffs, the 2008 South Tarawa survey described in the Kiribati chapter of this publication shows that more than three times the 2010 census number of people fish in just the open ocean near Tarawa. If "deepsea fisherman" refers to people who work on offshore fishing vessels, there are at least twice that number working on just the Japanese pole-and-line fleet (Gillett 2015).
- Because the commercial fisheries in most Pacific Island countries and territories 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 they typically receive responses 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, rather than a fisheries-specific study (e.g. a national census, HIES, or labour survey). 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.

33.2 Participation of Women in Fisheries

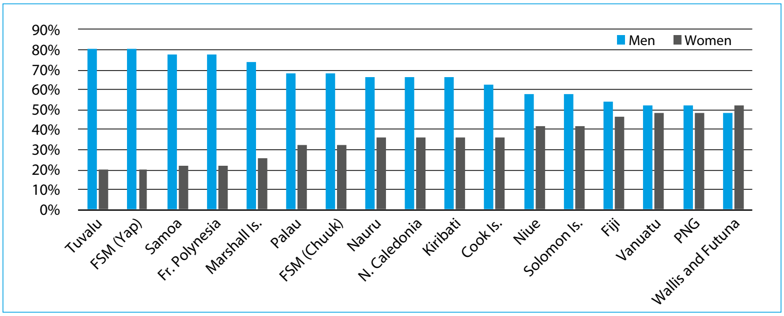
In the previous Benefish study (Gillett 2009) the readily available information on the participation of women in fisheries was presented. A substantial number of studies are listed in that document. One of the notable features of the present study is that there have been few studies on this subject since 2008. An opportunistic search for information on women in fisheries over several months in mid/late 2015 yielded recent findings in only seven countries/territories:

- Niue: The 2009 agriculture census of Niue found that, of the 564 people who engaged in fishing the week before the census night, 201 were females and 363 were males.
- PNG: In 2011 tuna processing employed 4,911 women, i.e. woman accounted for 73% of employment related to tuna processing.
- Samoa: A 2012 socio-economic fisheries survey contained much information on gender roles in fisheries. The report stated that both men and women fished around three times per week, with men fishing for an average of 4 hours and catching (on average) 13.7 kg per fishing trip, and women fishing for an average of 5 hours and catching (on average) 10 kg per fishing trip. Men fished about 10 months out of the year, and women fished about 9 months out of the year.
- Solomon Islands: A 2011 report had some information about the role of women in fisheries. It stated that fishing was predominantly a male activity (90% of men participate) with at least one female household member (50% of women) engaged in fishing. Women were engaged in trading of garden and fish products, including cooked food, as well as weaving, production of shell money, and employment in industrial fish processing plants. In the main fish canning factory in Noro, 80% of the 500 workers were women.

- Tuvalu: A "time use" study was carried out in 2013, with the objective of gathering evidence on how men and women in Tuvalu used their time during a day. The study found that men spent an average of 1.37 hours per day fishing, while the amount for women was 0.08 hours.
- Vanuatu: A 2010 report on the Millennium Development Goal stated that a large number of women were engaged in the fisheries sector, however because "fishing" as an activity is usually identified only when selling is involved and women selling fish is not the norm in Vanuatu, women's activities in the sector remained largely invisible.
- Pitcairn Islands: An SPC (2011) travel report stated that there were eight part-time commercial fishers, seven men and one woman.

Given the many gender-oriented studies in the decade prior to 2008, the few studies on women in fisheries since 2008 is curious. The work of the Forum Fisheries Agency (FFA) in developing national tuna management plans in the early 2000s often included studies of the role of women in tuna industries at the request of the donor – but that work was completed prior to 2008. A review of FFA programmes in mid-2014 (Gillett 2014) urged the agency to include a gender component in its tuna employment surveys – but that work has not yet begun. SPC had a "women in fisheries" section – but that entity took on a larger role several years ago, broadening its ambit to community fisheries. Another possible explanation for the reduced amount of information on women in fisheries in recent years is that gender studies may have continued at the national level, and the documentation is less available than for regional studies.

The SPC ProcFish surveys provide readily available information on the participation of women in fisheries, and they provide the bulk of the information cited in the country and territory chapters of this publication. 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.



Source: SPC (2013)

Figure 33-1: Participation of Men and Women in Fishing (%)

33.3 Age and Fisheries-Related Employment

Detailed age-related fisheries employment data are readily available only for Kiribati (Table 33-1), Tonga (Table 33-2), New Caledonia and Cook Islands.

Table 33-1: 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 2012)

Table 33-2: Involvement in Fishing by Age Class in Tonga (%)

All ages	15-19	20-24	25-29	30-34	35-39	40-44
2.0%	0.8%	1.3%	1.9%	2.6%	2.9%	3.4%
45-49	50-54	55-59	60-64	65-69	70-74	75+
3.4%	2.8%	2.4%	1.6%	1.4%	0.6%	0.3%

Source: Tonga Statistics Department (2012)

In New Caledonia the following information is available on the age of fishers:

- A study in Province Sud of 82 fishing captains showed that in 2013 the average age was 52 years, about 30% were older than 60, and 43% were less than 50 (Province Sud 2014).
- A study in 2013 stated that, despite the population of New Caledonia being young, 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 was 50 (CNP-MEM 2013).

The Cook Islands 2011 census has some information on the age of fishers. For those residents that are engaged in gardening, tending livestock and fishing as an unpaid activity, participation is highest in the mid-40s age group (about 30% of that age group participates in fishing), whereas there is less participation by teenagers (20%) and by the mid-20s age group (24%).

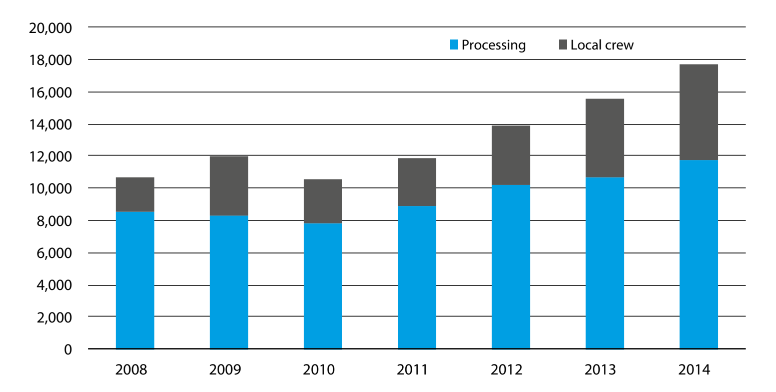
Other than the above, not much information is available on the participation of youth in fisheries. This is ironic considering that youth unemployment is a major problem in the region. A report on the state of Pacific youth (Curtain and Vakaoti, 2011) indicated that the shortage of jobs was at the top of the list of problems that young people faced.

33.4 Employment Related to Tuna

In the early 2000s several FFA studies included information by country of employment related to tuna. From 2008 a system was formalised whereby all FFA member countries reported on tuna industry indicators, including employment. Using this information, a summary of the jobs by year and country is given in Table 33-3 and summarised in Figure 33-2. The information presented circumvents many of the difficulties that hamper the broader fisheries employment studies mentioned above. Information is collected in a uniform manner across the region for defined categories of work.

Table 33-3: Employment Related to Tuna in FFA Member Countries, 2008–2014 (number of people)

	Processing and ancillary							Local crew						
	2008	2009	2010	2011	2012	2013	2014	2008	2009	2010	2011	2012	2013	2014
Cook Islands		12	16	18	20	15	7		10	9	13	9		9
FSM	134	198	182	151	97	65	65	313	40	47	44	49		49
Fiji	1,225	1,054	630	1,018	1,063	1,452	2,000		1,290	228	353	531	1,227	1,667
Kiribati	10	3	7	15	57	75	75	66	106	126	158	223	355	720
Marshall	414	443	587	566	560	503	588	537	516	608	581	612	610	678
Niue	2	1						3	5					
Palau	7	8	7	84	70	36	36		3					
PNG	6,715	5,783	5,600	5,962	6,640	7,000	7,536	819	1,102	1,102	1,153	1,509	1,776	1,776
Samoa	60	64	52	46	71	33	20	275	177	307	271	266	220	237
Solomon Islands		697	687	987	1,602	1,361	1,470		120	115	120	239	274	274
Tonga	21	20	14	17	6	15	12	54	30	17	9	6	7	33
Tuvalu					2	2	2		213	203	205	246	363	363
Vanuatu		20	15	27	25	84			132	37	20	9	46	46



Source: FFA (2015)

Figure 33-2: Employment Related to Tuna in FFA Member Countries, 2008–2014 (number of people)

FFA's 2015 Economic Indicators Report (FFA 2015) gives more detail on the dynamics of employment in the tuna industry in the region (Box 33-1).

Box 33-1: Tuna-Related Employment Information

Total tuna related employment (including government and industry) increased steadily between 2008 and 2014 rising from around 12,000 to 18,000 in 2013 and 22,736 in 2014, underpinned by growth in the onshore processing sector employment whose force comprises mostly women at between 70% and 90%. This sector accounts for more than 50% of total tuna related employment. The onshore processing sector is currently employing almost 12,000 as compared to less than 9,000 in 2008. PNG accounts for 64% of employment in the processing sector with Fiji 17% and Solomon Islands 12%. It is noted that the rise in total employment figures in 2014 reflects not only new investments in PNG but also inclusions of previously excluded enterprises in the data surveys. Greater opportunities are opening up for employment especially in the processing sector. For example, in PNG, several new canneries/loin factories recently commenced or are about to commence operations and a total of 13,500 direct jobs are expected to be created.

Source: FFA (2015)

33.5 Employment in Other Fishery Subsectors

A number of estimates have been made of employment in particular fishery subsectors across the region. Many of these are quite dated. The basis of the estimates ranges from specialised detailed studies to more casual conjecture.

These studies include the following:

- Aquaculture: "More than 7,000 people are employed full-time or part-time in coastal aquaculture, including 5,000 jobs in French Polynesia and 200–600 jobs in each of Cook Islands, Fiji, New Caledonia and Solomon Islands" (Amos et al. 2014).
- Government fisheries agency staff: "Approximately 1,277 staff are employed in PICT fishery agencies, not counting observers and temporary project staff" (Govan 2015).
- Large- and small-scale commercial fishing: Using estimates of vessel numbers, "about 45,000 Pacific Islanders appear to be presently involved in commercial fishing in the region" (Gillett and Lightfoot 2001).
- Foreign fishing vessels: "There are about 1,200 men from the region working on the 10 major fleets. The major employers are Japan (about 30% of the employment), Korea (24%), United States (15%), and Taiwan (13%)" (Gillett and McCoy 1997).
- Trochus processing: "The 14 operational trochus factories in the Pacific Islands employ 213 workers" (World Bank 1997).

Given the amount of effort that regional organisations have focused on discrete fishery subsectors 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 marine aquarium industry, NGOs involved in fisheries work, domestic fish marketing, beche-de-mer diving/processing, or commercial sportfishing.

With respect to estimating regional employment in fishery subsectors, 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 efforts to estimate aquaculture employment in the region are commendable.
- Some degree of standardisation in terminology and units of measurement is important. It is not very meaningful to compare the number of "full-time equivalents jobs" in one study to the number of people having "full-time or partial employment" in another study.

33.6 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 those difficulties identified above. With the possible exception of employment related to tuna, little recent information is available quantifying employment by fishery 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 precise 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 Fishery Product Consumption

34.1 Per Capita Fishery Product 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 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 2009; 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, while that in the "Bell et al." column comes (with one exception) from HIES work (Bell's estimates for annual per capita consumption are included to show the large difference between his estimates and others). Figure 34-1 graphs the information from Table 34.1 (minus the outliers).

1 Fish is used to mean finfish and edible invertebrates.

Table 34-1: Estimates of Annual Per Capita Fishery Product Consumption

Country Territory	Range in Estimates (from many surveys) *(kg/person/year)	Bell et al. (2008) (kg/person /year)	Other Information
Cook Islands	47.0–71.0	34.9	Most fish consumption studies are focused on Rarotonga. Some studies appear to have used food value while most have used whole fish equivalent.
Fiji	44.0–62.0	20.7	The annual supply of fish to the Suva area by the locally based offshore fleet is about 11.8 kg/person.
FSM	72.0–142.0	69.3	Annual per capita consumption of domestic coastal fishery products is estimated by present study to be 49.9 kg. To this must be added consumption of offshore fishery products and imports.
Kiribati	72.0–207.0	62.2	Rejected fish from purse seine transshipment in 2014 was about 7.5 kg per resident of South Tarawa and Betio.
Marshall Islands	38.9–59.0	–	If the coastal fisheries production in 2014 of 4,500 mt (estimated by the present 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 who consume local fish, or domestic consumption of the leakage from tuna transshipment operations.
Nauru	46.7–63.9	55.8	The 46.7 kg was from the late 1990s. The fish consumption rate is likely to have changed remarkably since then.
Niue	49.0–118.9	79.3	Two types of estimates from the SPC ProcFish survey results suggest very different consumption rates: 112 kg vs 51 kg.
Palau	84.0–135.0	33.4	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.
PNG	18.2–24.9	13.0	The Bell et al. (2008) estimate was from a non-HIES survey.
Samoa	46.3–129.5	87.4	The latest survey (Tiitii et al. 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	33.0	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	25.2 – 35.0	20.3	Offshore fishery production equates to 1.6 kg/person/year for all of Tonga.

Table 35-1: continuation

Country Territory	Range in Estimates (from many surveys) *(kg/person/year)	Bell et al. (2008) (kg/person /year)	Other Information
Tuvalu	85.0–146.0	110.7	A Fisheries Department report summarised the results of many studies on the level of consumption of marine resources in Tuvalu: consumption rates vary from island to island, but are in the range of 100–200 kg/person/year.
Vanuatu	15.9–25.7	20.3	
American Samoa	15.5	–	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	70.3	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	–	
New Caledonia	21.6	25.6	The production from offshore fisheries equates to about 26.2 kg/year for each of the 100,000 residents of Noumea.
Northern Marianas	23.0	–	Estimating fish consumption is complicated by the 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.
Pitcairn Islands	153	–	Only 49 residents.
Tokelau	119.4	–	There is a substantial amount of imported protein food products.
Wallis and Futuna	–	74.6	The present study estimates the 2014 annual consumption of domestic fishery products to be 68.7 kg per capita, but this does not consider imports.

Note: Outlying estimates have been eliminated
* Single-figure estimates are the result of the only recent and reliable estimate available
Source: The present study, and Gillett and Lightfoot (2001)

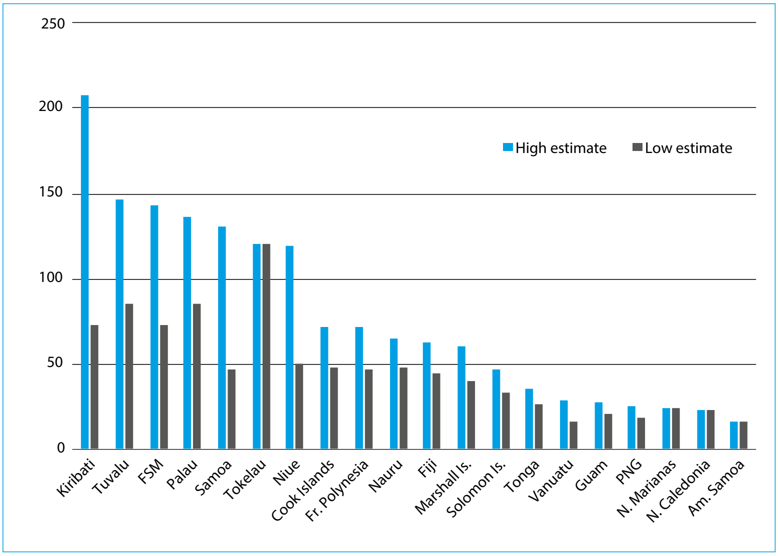


Figure 34-1: Ranges in Estimates of Annual Per Capita Fish Consumption (kg/person/year)

Some observations on the above table and graph are as follows:

- In general, the countries that are made up mostly of atolls (Kiribati, Tuvalu, FSM) have the highest fish consumption rates. The relative position of Marshall Islands on the graph is counterintuitive (as an atoll country Marshalls would be expected to have a relatively high annual per capita consumption, but it does not), while the relatively low position of Tokelau can be explained by its close association with New Zealand, and consequently its relative affluence which allows high levels of imports of protein alternatives to fish.
- The countries that have the lowest fish consumption rates are those that either have large inland populations (PNG, Vanuatu) or are relatively affluent.
- Several of the countries that have moderately high fish consumption (FSM, Palau, Samoa) have locally based longline fleets.
- The notes in the table suggest growing consumption of damaged fish from purse seine operations – and at least some effectiveness of measures to prevent those fish from being dumped.
- 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 also may 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 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 mt to 312 mt 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 World Bank (1995) which 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, as reported to FAO."
- The FAO consumption figures come 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. 2009).

- Most of the Pacific Island countries and territories exceed by a large margin the world average per capita fishery product consumption rate of 15.4 kg (FAO 2015).
- Loke et al. (2012) state that the three countries with the highest annual per capita consumption of seafood in the world are Maldives (142.2 live kg), Saint Helena (92.6 live kg) and Iceland (90.8 live kg). An FAO project estimated that Maldives has the highest annual per capita consumption of fish in the Asia-Pacific region, i.e. 185.9 kg (Sugiyama et al. 2004).

34.2 Measuring Fish Consumption

In the table above, comparing the "range of estimates" column to the Bell et al. (2008) estimates for the annual per capita consumption, the latter estimates are often less than the lower end of the range. This is consistent with an observation on the use of HIES for fisheries work: "A feature common in many countries of the Benefish Study is to have the coastal fisheries production estimated by a HIES to be relatively low. The HIES[2] generally suggests fish catches significantly smaller than that estimated by other survey techniques" (Gillett 2009). 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 other 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 ProcFish study in Niue in which two different assessments suggested very different annual consumption rates (51 kg vs 112 kg). In the earlier Benefish study (Gillett 2009) 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 (used a mixture of food weight and whole fish equivalent) and one in 2006 (that used food weight). Changes in per capita consumption between the surveys were calculated and attributed to specific factors (i.e. ciguatera, fisheries management measures).

2 This statement refers to the conventional HIES, and not the «fisheries-friendly» HIES discussed in Chapter 29.

Several observations can be made from the above. One is that the determining of 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, and 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; or "seafood" is sometimes used, 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 and whether there is any correction for differential consumption by tourists.

A final observation is that a surprising number of comments on fish consumption in the region are simply wrong. As one of many examples, a report by the Asian Development Bank (ADB 2014) states:

> Solomon Islands has one of the highest per capita fish consumption rates in the world. Bell et al. (2009) estimated that the average annual per capita fish consumption in urban areas was 45.5 kilogram (kg) and 31.2 kg in the rural areas, while the national average was 33 kg (90% consisted of fresh fish). However, these figures may be an underestimation (Weeratunge et al. 2011) since Pinca et al. (2009) estimated annual per capita fish consumption between 98.6 kg and 110.9 kg.

The reality is that Solomon Islands is far from having one of the highest fish consumption rates in the world (it is even below average for the countries in the Pacific region) and the range cited in the Pinca et al. (2009) study was not for the whole country, but rather for four villages chosen because "they had active reef fisheries" (Pinca et al. 2009), something that is not representative of the entire country.

34.3 Fish Consumption Rates and Fisheries Management

Per capita fish consumption data are important in 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. (2008) 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 Other Observations

35.1 Some Observations on Coastal and Offshore Fishing

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: contribution 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 and more abstract benefits (contribution 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 19% of GDP across the region	Substantial in some countries but across the region much less important than locally based offshore	Zero	Large in most countries	Very large
Coastal Subsistence	About 22% across the region	Zero	Zero	Large in most countries	Very large
Offshore Locally Based	About 42% across the region	Large in countries with local fleets	Substantial in some countries	Substantial only in PNG and Fiji, but much less than coastal fisheries	Significant in countries with local fleets
Offshore Foreign Based	Zero	Zero	Large in most countries	Much less than locally based offshore	Some in countries with lots of tuna transshipment
Freshwater	About 6% across the region, most in PNG	Almost nothing except a very small amount from PNG	Zero	Only significant in larger islands of Melanesia	Only significant in larger islands of Melanesia
Aquaculture	About 7% across the region; almost all from two French territories	Most aquaculture production is exported	Zero	Large in French Polynesia and New Caledonia. Significant in only those few countries where there is an aquaculture industry	Significant amounts of tilapia in PNG, Fiji and Vanuatu, with much smaller amounts in many countries. Most aquaculture production is exported

In the fisheries production section, above, the fisheries production in independent Pacific Island countries, as estimated by three Benefish studies, is given for the years 1999, 2007 and 2014, in Chapter 30, and is repeated in Figure 35-1.

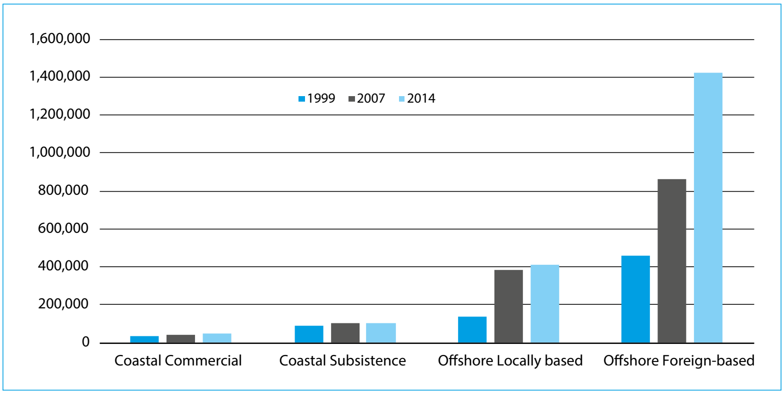


Figure 35-1: Fisheries Production by Volume of the Independent Pacific Island Countries[1] in 1999, 2007, and 2014 (mt)

The figure shows one of the most significant findings of the present study: coastal fisheries production has not increased significantly in the 15-year period 1999–2014. There are indications at the national level that this lack of increase is despite increasing fishing pressure. This is consistent with the idea that, for the region as a whole, the fish resources that support coastal fisheries are fully or over-exploited. Because the population of the region is increasing, the per capita production of fish from coastal fisheries is decreasing, by about 6.0% for the entire region over just the 2007–2014 period. This is a remarkable drop in such a short period.

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. 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.[2]
- The ineffectiveness of other interventions perceived to be easy alternatives to restrictive management (e.g. the use of alternative livelihoods).

1 The study of fish production in 1999 did not include the Pacific Island territories, hence only data from the independent countries are compared in the figure.

2 As expressed by one regional fisheries specialist, who pointed out "the futility of trying to use good aquaculture to make up for bad fisheries management".

- 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).
- Increased attention to the narrow issue of reef shark conservation at the expense of broader coastal fisheries management.
- Fisheries agency fatigue.

Foreign-based offshore fishing continues to rise, with that category of fishing responsible for almost all of the regional increase in fish catches in the 2007–2014 period (as highlighted in Chapter 30). This was mostly due to expanding purse seine catches (Williams and Terawasi 2015). The expanding catches occurred despite the introduction of the Vessel Day Scheme and the associated large increase in access fees, mostly paid by the foreign purse seine fleets. The biggest jump in access fees was between 2013 and 2014 (for countries where it was possible to get access fees for both years) even though prices for skipjack (the main target of purse seining) decreased from 2013 to 2014.

These changes taken together are a powerful argument for the effectiveness of the Vessel Day Scheme.

The catch from locally based offshore vessels increased from 1999 to 2007, but remained flat between 2007 and 2014. As explained earlier, this is not likely to reflect stagnant performance of locally based fleets, but rather the influence of a temporary El Niño shift from the west (where there are lots of locally based vessels) to the east (where there are fewer).

35.2 Some Observations on the Measurement of Fisheries Benefits

Over the period 2001–2015 one of the most striking changes in relation to measuring fisheries benefits is the reduction in the amount of fisheries information that is 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 to 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. In this respect, the annual report of the Marshall Islands Marine Resources Authority is exemplary. Regional and international development agencies should consider an initiative to increase the capacity of government fisheries agencies to produce good annual reports. Such reports could contain much of the information that proved very hard to access during this study.

Another feature of the measurement of fisheries benefits is that, although statistics on offshore fisheries production are getting better, estimates of coastal fisheries production appear to be getting worse. Because older coastal fisheries statistical systems are decaying and there have been few national "snapshot" surveys in recent years, there is greater use of a tonnage number generated in the increasingly distant past (referred to earlier as "inappropriate recycling of antiquated information"). 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 assure relevance of those surveys to fisheries is cooperation between fisheries and statistics agencies.

In Chapter 33 on employment related to fisheries, the following was stated:

> 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.

This was written for employment information – but it is equally relevant for information on GDP, exports, and to some extent production levels (i.e. the use of HIES for obtaining fisheries production information).

Several Pacific Island countries and territories have ongoing statistical systems for coastal fisheries, and have the infrastructure in place to estimate coastal fisheries production. However, most are in varying states of dysfunction, with the credibility of estimates of production unknown. For example, during the present survey it was found that in one country the estimate of coastal fisheries production from a recent snapshot survey was 74 times that produced by the ongoing catch survey. It would not be very difficult for a specialist in small-scale fisheries statistics to examine the existing coastal fisheries statistical systems and offer advice on the credibility of estimates produced, and suggest ways the estimates could be improved.

Surveys that produce "baseline information" were not very helpful to the present survey. In the SPC ProcFish studies, in each country a few specific places were studied and baseline information established for those places – but any production information produced could not be extrapolated to the national level. At least one attempt has been made to raise ProcFish production estimates to obtain a national production estimate (Arena et al. (2015), for Solomon Islands) – with the results likely to be erroneous. Also noteworthy is that the ProcFish baseline studies are not directly comparable to similar work conducted by the more recent SPC climate change baseline assessments. According to the survey reports, the two sets of surveys were not conducted at exactly the same location and hence further monitoring is required to determine whether observed differences are real.[3]

3 Another aspect of the ProcFish surveys is whether the work produced data useful for management by the communities. In an FAO study of fisheries management at Muaivuso a ProcFish site in Fiji, the community stated they used many sources of information to assist in the management of their fishery area, but the ProcFish results were not mentioned (Gillett 2014).

36 Recommendations

36.1 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.

The above table contains a considerable 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 fisheries/statistical cooperation. In this regard, the 2009 SPC Workshop on Using HIES and Censuses in Fisheries appears to have had a positive impact on fisheries and statistics attendees, and perhaps similar workshops could promote further improvement in this area. Other mechanisms include having fisheries presentations at regional statistics meetings and distribution of the present study to statistics agencies in the region.

The paucity of information on coastal fisheries production is a problem in most countries in the region. If fisheries agencies cannot afford some type of snapshot fisheries survey consideration should be given to obtaining information from studies outside of the fisheries sector, such as a HIES, agriculture census or national census. However, again, cooperation with statistics agencies is critical in ensuring the relevance of those surveys to fisheries.

Three other suggestions for improving the measurement of benefits have been mentioned in sections above:

- Some assistance by a specialist in small-scale fishery statistical systems could either improve coastal fishery production estimates from ongoing fisheries statistical systems, or confirm their credibility. Fiji, Kiribati and Samoa, as well as other countries, could benefit from such reviews.

- Assistance from regional and international development agencies in the production of good fisheries agency annual reports could encourage the flow of information on coastal fisheries. There would be a range of useful impacts of this, in addition to contributing to better measurement of fishery benefits.

In the analysis of benefits from specific fisheries sub-sectors, efforts should be taken to ensure that the analytical work is entirely independent of individuals involved in promoting the sub-sector.

Table 36-1: Improving the Measurement of Fisheries Benefits

Benefit Category	Suggestion 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. • For those countries that have long-established market surveys, an objective analysis should be carried out to determine the accuracy of estimating the national catch from the sampled amount. • For those countries that have not made an estimation of the production from coastal fisheries for many years, a snapshot survey should be considered. • Alternatively, in some countries it may be more appropriate to estimate coastal fisheries production from surveys outside the fisheries sector, such as a national census or a household income and expenditure survey (HIES). For both of those, there should be good cooperation between the government fisheries and statistical agencies in the planning of those surveys. • For countries that are contemplating HIES work to estimate coastal fisheries production, consideration should be given to using the new "fisheries-friendly" HIES.
GDP	• Statistics staff should obtain technical fisheries expertise when devising methodology, collecting data, making the estimate and reviewing the results of estimating the fishing contribution to GDP. • Statistics staff should compare their estimates of the fishing contribution to GDP with estimates in the countryan teritoty chapters of this book, and evaluate the differences and any need for modification of the methodology. • When using the production approach for estimating fishing contribution to GDP, the analyst should: (a) formulate logical fisheries categories that group similar fisheries with similar value added ratios; (b) in the absence of specialised economic studies in the relevant country, the suggested value added ratios in Appendix 3 of this book should be used; and (c) for estimates of offshore fisheries production, the WCPFC national fisheries reports should be used. • The results of past "informal" and "specialised" studies used in estimating the fishing contribution to GDP should be critically reviewed. • In the longer term, and on the level of regional/international institutions supporting Pacific Island fisheries, considering should be given to additional work in the areas of value-added ratios, the GDP status of locally based foreign fleets, and formulating satellite accounts for fisheries.

Table 36-1: continuation

Benefit Category	Suggestion to Improve Measurement
Exports	• Government fisheries agency staff should scrutinise 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. • The official value of tuna exports should be compared with the values on the FFA Excel spreadsheet, "The Value of WCPFC Tuna Fisheries", available from the Fisheries Development Section of the FFA, Honiara; large differences should be reconciled. • For the fisheries agencies that carry out 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.
Govern-ment Revenue	• Where there are large differences in the amount of access fees given by different government agencies, those differences should be reconciled. • In the few fisheries agencies in the region which apply secrecy surrounding access fees, there should be an evaluation of the costs and benefits of that secrecy, bearing in mind the transparency in neighbouring countries. • The annual reports of government fisheries agencies should provide a reconciled list of access fees and other government income (e.g. domestic fishing licence fees). • In terms of both good governance and giving due credit to the fisheries sector for any revenue generated, it would be sensible to track the significant revenue generation and make the results readily available to fishery stakeholders. Dedicating a small section in the annual report of the government fisheries agency, such as that done by the Fisheries Department in Fiji, would be relatively easy, and could institutionalise this process.
Employ-ment	• Considering that much of the information on fisheries-related employment is a heterogeneous assemblage of facts and information (information that is literally "all over the place") conceptual work should be undertaken by the regional/international agencies that support Pacific Island fisheries on the measurement of fisheries-related employment, taking advantage of worldwide experience, both inside and outside of the fisheries sector. • Some degree of standardisation in terminology and units of measurement should be applied. It is not particularly meaningful to compare the number of "full-time equivalents jobs" in one study with the number of people having "full-time or partial employment" in another. • There should be significant fisheries technical input to the design and implementation of general national surveys carried out by statistics agencies that are intended to obtain comparative information on fisheries-related employment.
Nutrition	• Reports of fish consumption studies should state very clearly what they are measuring: (a) food actually consumed or the live weight of the fish that produced the food; and (b) the consumption of just finfish, or all seafood, or all aquatic foods. • 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 are corrected so that the data are in comparable form.

36.2 Higher-Level and Longer-Term Recommendations

The trends in coastal fisheries production given in this report are quite significant, and lead to a number of recommendations. On the issue of the work of fisheries agencies of the region, there should be an evolution in thinking, from efforts to extract more benefits from coastal fisheries (coastal fisheries development) to efforts to maintain the existing flow of benefits (coastal fisheries management). Similarly, the assistance that regional and international development partners provide to the fisheries sector at the national level needs to focus more on coastal fisheries management. Recent trends in coastal fisheries also indicate that there has already been a dietary impact of the changes in coastal fisheries production, further strengthening the argument for increased attention to coastal fisheries management. This sentiment has appeared in several regional proclamations (Box 36-1).

Box 36-1: Regional Proclamations on the Need for More Focus on Coastal Fisheries Management

- The Declaration at the Pacific Beche-de-Mer and the Future of Coastal Fisheries Meeting (August 2014), which was signed by the seven fisheries ministers, states: "On the state of Coastal Fisheries, participants recognise… The over-exploited state of coastal fisheries in all Pacific Island Nations and calls for urgent action to improve the management of coastal fisheries to be sustainable… It is timely to shift the emphasis in coastal fisheries management".
- In 2012 the MSG Inshore Fisheries Working Group, comprising senior Fisheries Department officials from Fiji, New Caledonia, PNG, Solomon Islands and Vanuatu worked to produce the MSG Roadmap for Inshore Fisheries and Food Security. That document stresses the need for more attention to the management of coastal fisheries, and states: "The costs of improved inshore fisheries management in general would be offset by benefits to the national economies."
- The outcome document of the March 2015 SPC regional workshop on the future of coastal/inshore fisheries management states: "Now is the time for government to ensure there is an appropriate level of resource to securing the considerable economic and other benefits that flow from the sustainable management of coastal fisheries."

The remarkable drop of per capita production from coastal fisheries over the period 2007–2014 alone (6%) 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 there is a moral and professional obligation to pursue the difficult task of implementing effective coastal management measures with greater vigour.

Access fees for foreign fishing expanded greatly between 2007 and 2014. In real terms (i.e. inflation adjusted) the access fees for the region increased 279% 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 increase 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.

37 Concluding Remarks

37.1 This Study and Similar Work in the Future

Because work similar to that of the three Benefish studies is likely to be undertaken in the future, it may be useful to note some of the lessons learned across these studies. Firstly, a number of features of the research work in 2001, 2008 and 2015 were quite favourable, including the following:

- The report is very time-sensitive. Although the time frame for preparing, collecting, analysing and writing was tight (160 days), by having the work schedule compressed it encouraged getting the report out in a timely manner.
- The institutional culture of SPC enables the production of such a major work within an established publishing schedule.
- 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 is not specifically qualified.
- In the present study 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. Much valuable assistance was received from FFA and PNA.
- Cooperation with the FFA Economic Indicators Project proved mutually beneficial.
- Commencing work in mid-August is strategic, because tuna catch data and macro-economic data from the previous year begins to become available at that time.

- The supervising officers for all three Benefish studies adopted appropriate levels of involvement: that is, 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.

The major difficulty of the present study concerned the provision of data in country. In many instances of country requests for data, information was not provided as discussed, despite follow-up. Future efforts would benefit from collecting as much information as possible while in country, with an awareness of the fall-off in responsiveness to data requests once the researcher is off-site.

A number of changes should be made to future Benefish studies, including the following:

- There is a need to get young Pacific Island fisheries professionals involved in this work. Consideration should be given to attaching an individual to the main consultant for capacity enhancement purposes, to provide that person with the necessary skills and experience to carry out similar studies in the future.
- In the 2008 Benefish work a number of "add-on" studies were included (e.g. fuel and climate change) that had little to do with the main goal of quantifying benefits. The lesson is that it would have been better to resist such additional focus areas, and to retain focus on the core areas. In the current study there were attempts to add some extras, but the additional work was resisted. 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 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 initial pilot development in one country of a satellite account for fisheries in the national accounts – similar to what has been done for tourism in many countries.
- Additional work needs to be done on the appropriate methodology for quantifying and comparing fisheries-related employment. In the

regard, fisheries is more difficult than other sectors, with work ranging from small involvement in subsistence fishing, to labouring for months overseas on industrial vessels. The current employment studies produce mostly heterogenous assemblages of facts and information that are difficult to compare across other national sectors to obtain the absolute amount or relative importance of fisheries-related employment. Such an improvement is likely to require expertise in both fisheries and labour.

37.2 Some Key Points on Fisheries Production and Benefits

This study assessed the 2014 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 2 million metric tonnes,[1] worth US$3.2 billion. The total volume of regional fishery production increased by 431,354 mt, or 32%, in the period 2007 to 2014. Expressed in 2014 prices, in that period the value of fishery and aquaculture production increased by US$738,662,323, or 30.7%.

The following are some of the more surprising facts to emerge from the present study:

- 52.7% of all employment in the region that is directly related to the tuna industry occurs in Papua New Guinea.
- The 2014 tuna catch in Kiribati was 40.7% of the regional total, and was valued at about US$1 billion.
- 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 PNG having a population almost nine 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.

1 This does not include the value of aquaculture production, due to the use of two different units to measure aquaculture production. In 2014 the volume of aquaculture production of the region was 4,217 mt and 9,122,169 pieces.

- In only six PICTs of the region is aquaculture a significant activity (i.e. production value is greater than 5% of that of coastal fisheries). All but one (Cook Islands) of those are territories.
- American Samoa's fishery exports represent about 47% of the fishery exports from all of the other countries and territories combined. The value of PNG's fishery exports represents about 41% of all the value of fishery exports from all of the other independent countries combined.
- The total amount of fishery exports from the region fell by about 42% in real value in the period 2007 to 2014. The fall in the value of canned tuna exports from American Samoa was responsible for about 37% in the total regional decline.
- Access fees for foreign fishing increased by 279% in the period 2007 to 2014 (which coincided with the period when the Vessel Day Scheme was introduced and became fully operational).
- In 2014 four countries in the region received foreign access fees that represented more than $1,000 per capita of the respective countries' populations.

Appendix 1: Executive Summaries of Past Benefish Studies

Gillett and Lightfoot (2001) Study

The 2001 Gillett and Lightfoot (2001) study focused on the year 1999. The main findings, conclusions and recommendations of the report are summarised below:

Official data on the contribution of fishing to GDP

According to current official data in Pacific Island countries, the percentage contribution of fishing to GDP in 1999 (or latest prior year available) ranges 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 the large variations in the accuracy of the 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

The comparison between the official and the new estimates of fishing contribution to GDP is presented on Figure A1-1, below. The largest difference was 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 Marshall Islands, Samoa and, to a lesser extent, Cook Islands. On average, the new estimates indicated a higher contribution of fishing to GDPs than reported by national statistics (7.0% vs 5.4% across all countries).

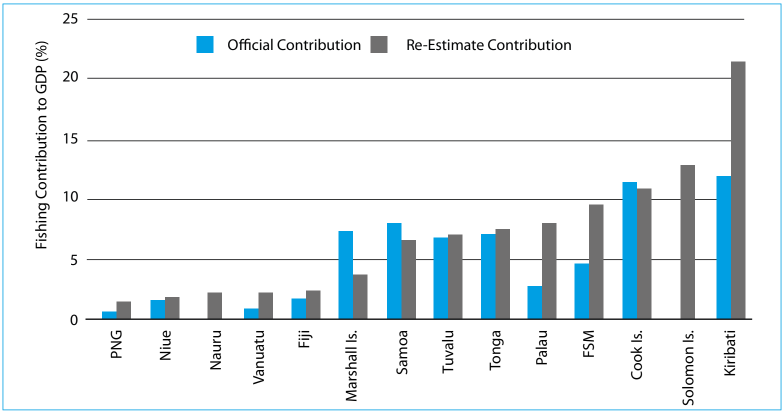


Figure A1-1: Comparison of Official and New Estimates of Fishing Contribution to the Gross Domestic Product of Pacific Island Countries

Major reasons for difference 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. 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

The common difficulties found in estimating the contribution of fishing to GDP in many Pacific Island countries include:

- 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. Because in the SNA scheme the processing of fish is outside the "fishing" sector, 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 the 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, contributing to its undervaluation in national statistics.

Fishery production in specific Pacific Island countries

Figure A1-2 and Figure A1-3 show the estimated fisheries production and annual value in Pacific Island countries.

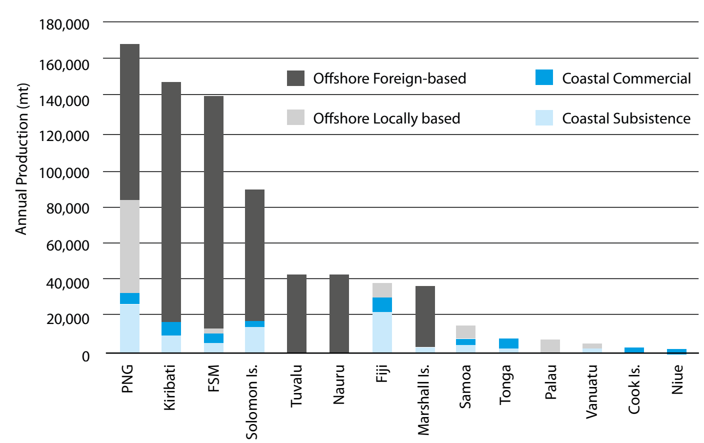


Figure A1-2: Estimated Annual Fisheries Production of Pacific Island Countries by Volume, late 1990s

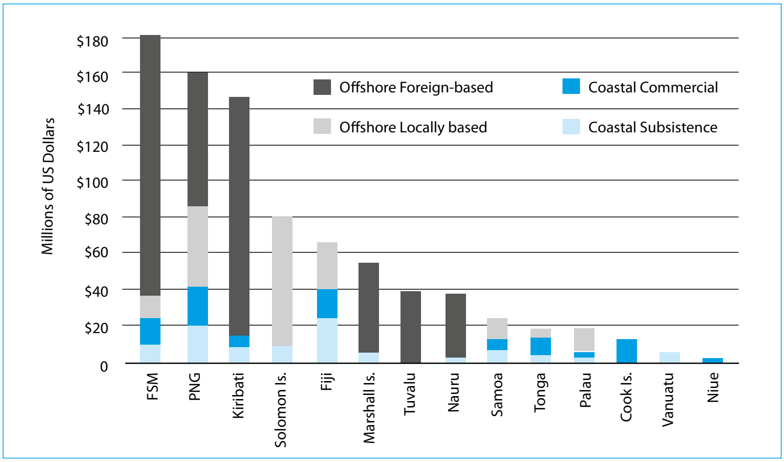


Figure A1-3: Estimated Annual Fisheries Production of Pacific Island Countries by Value, late 1990s

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.
- There is a general pattern of total national catches decreasing going from west to east across the region, and from equatorial to higher latitudes.
- 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:

- The importance of fisheries in the subsistence economy seems to be strongly related 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 employment in fisheries is generally understated due to (i) the practice of classifying activity according to a person's "main unpaid activity", which masks the importance of secondary activities—e.g. 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; and (ii) placing commercial fish processing (where many women are employed) 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 4 provides estimates of fisheries exports for end-1990.

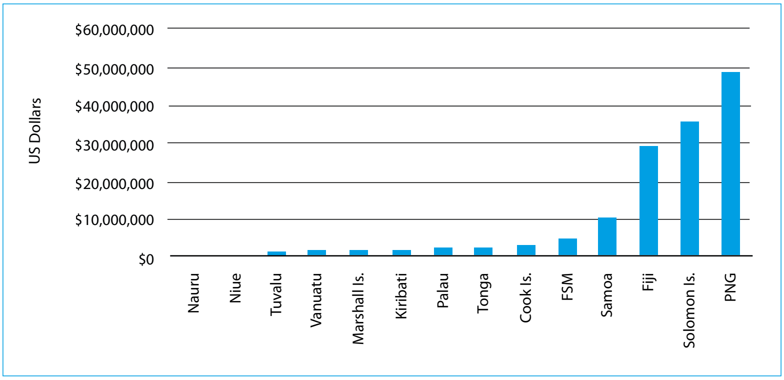


Figure A1-4: Estimated Values of Fisheries Exports of Pacific Island Countries, late 1990s

Features of the fishery import and export data

Some of the key features of fisheries trade in the region include:

- 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 the fishery imports.
- The relatively new aquarium fish industry is responsible for a significant portion of fishery exports. Aquarium fish export from Kiribati and the Marshall Islands now account for 78% and 95% of all fishery exports from those countries, respectively.
- There is considerable inter-annual variation in fishery exports.

The amount of fishery products exported as passenger baggage is quite large, especially in 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.

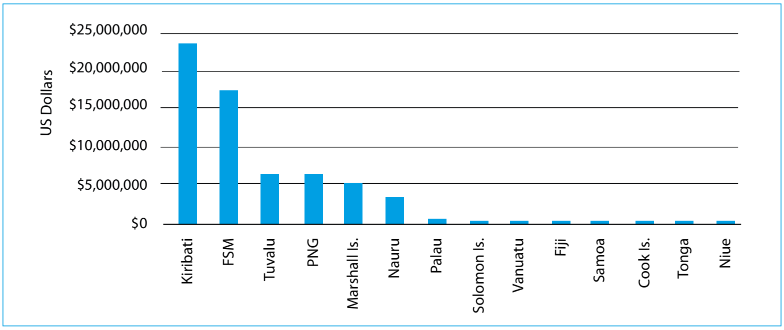


Figure A1-5: Estimated Access Fees from Foreign Fishing Vessels, 1999

Fish consumption

Key features of fishery product consumption in the region include:

- 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.

Ranges in per capita fish consumption

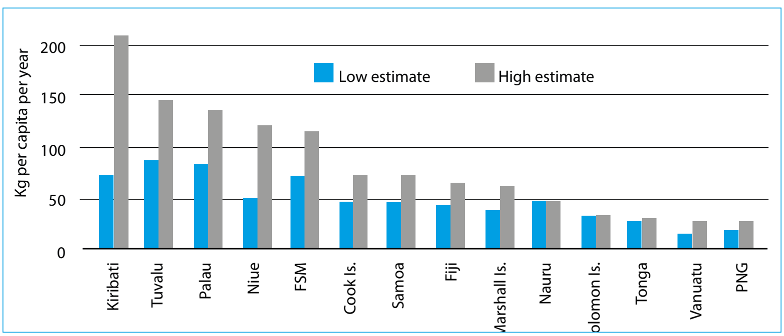


Figure A1-6: Ranges in Annual Per Capita Fisheries Consumption for Pacific Island Countries in the 1990s

Major conclusions

A major conclusion of the present 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, the assumptions, and the methods used.

The accuracy of the estimate of fishing contribution to GDP could be improved with a closer liaison between the fisheries and the 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 cooperation, 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 the 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, it is, however, rare for this data to be available. In these circumstances, the production approach is likely to produce the most accurate results.

Regional organisations could play an important role in improving the measurement of fisheries in the economies of their member countries.

Gillett (2009) Study

The Gillett (2009) study focused on the year 2007. The main findings, conclusions and recommendations of the report are summarised below:

The study

In 2008 discussions between ADB, SPC, FFA and the 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 from freshwater fisheries, and some important factors that are likely to affect the flow of benefits from fisheries in the future. It was decided ,to include the non-independent Pacific Island territories,

The content of this book

This report contains a fisheries-oriented discussion of macroeconomics, country information on specific topics (fisheries production, contribution to GDP, etc.), a discussion 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 have emerged from this study, and finally, 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 the recent, readily available data in the following areas:

- The recent 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 a locally 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 mt, plus an aquaculture production of 2,984 mt and 305,336 pieces. The total value of fisheries and aquaculture production in 2007 is estimated to be about US$0.

Offshore foreign-based fishing is responsible for about half of 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 by PNG and moderate increase by most other countries. By category of fishing, there were substantial production increases for the offshore fisheries, whereas the coastal fishery production levels showed no over-all change.

The estimated value in each country of six fishing categories: coastal commercial fishing, coastal subsistence fishing, locally based offshore fishing, foreign-based offshore fishing, freshwater fishing, and (6) aquaculture:

Value of national fisheries production in 2007

Table A1-7: 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

Relative value of regional fisheries production by sub-sector

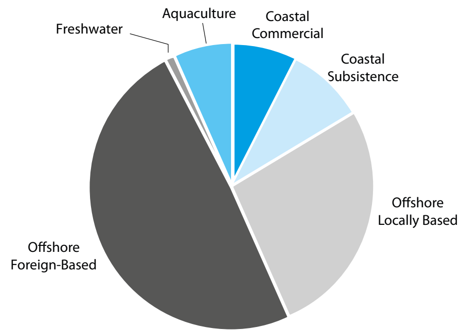


Figure A1-7: Relative Value of Fisheries Production

Aquaculture production

If 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 subsidization, 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 the estimates of coastal commercial and coastal subsistence catches. There seem to be three types of situations, however, where good estimates are available:

- Countries that have a dedicated on-going 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 household income and expenditure survey (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 in 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

The 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). The 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 the present 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: (a) obtain technical fisheries expertise when devising methodology, collecting data, making the estimate, and reviewing the results; and (b) 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 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 the 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 (a) employment in commercial fisheries, and (b) and 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 least in large high islands; and (b) The importance of fisheries in formal employment seems to be related more to business conditions than to island type. These conditions include, among others, the 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 report (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 - come 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

In recent years most Pacific Island countries have had a household income and expenditure survey (HIES). All of the independent Pacific Island countries and several of the territories are planning for a HIES in the next few years. 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 feature common in many countries of the present study was to have the coastal fisheries production estimated by a HIES to be relatively low. The way forward appears to be for fisheries specialists to cooperate with HIES specialists on an initiative for improving the applicability of 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 $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 Islands 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 the present study:

- During the period 1999 – 2007 the relative contributions to GDP (i.e. ratio of fishing contribution to total GDP) increased in eleven countries and decreased in three.
- In nominal terms, fisheries exports of the region almost doubled in the period 1999 – 2007. Fishery exports have 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 over-all 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 over-all 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 alternatively, it could 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 its 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 report the 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 the present 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 field work lead to two general suggestions for improvement:

- 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 of the subsidy, and whether alternative mechanisms could 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 a closer liaison between the fisheries and the 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 cooperation, however, rarely occurs in the Pacific Island countries.

Appendix 2: National Accounting and the Fisheries Sector

The Contribution of Fisheries to the Economies of Pacific Island Countries (Gillett and Lightfoot, 2001) gave considerable detail in discussing points in 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 households own 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 in 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 "center of economic interest" is within the country. The "center 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 domestic product provided the country is the "center 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 "center 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 "center 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 (i) how to treat fishing activities that take place in other jurisdictions, and (ii) how to treat those that take place in international waters.

When the fishing occurs in the waters of another country, the determination of how to treat that activity in the national accounts depends upon the duration of the activity and its "center of economic activity". The SNA indicates that temporary work in a foreign country should be treated as domestic product in the home country (the center 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, 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 places. 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 so as to remove the effects of price inflation and thereby allow the comparison of real changes over time. It is also common for the international agencies such as ADB, International Monetary Fund (IMF), United Nations (UN), and World Bank to produce national accounts using the equivalent value of a convertible currency, usually the United States dollar (US$). This practice makes it easier to do cross-country comparisons and to track the 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 over-exploitation 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 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 over-exploitation 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 through post-harvest handling, transport, processing, and marketing.

The conventions used in the SNA and those followed in this report 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, but rather 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 rigor 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 for 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, the 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 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 in 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: (i) locally based offshore fishing (foreign-based fishing in a country's zone does not contribute to that country's GDP), (ii) coastal commercial fishing, (iii) coastal subsistence fishing. In the Pacific Island countries that have significant freshwater fisheries (e.g. PNG, Fiji) or aquaculture (e.g. Cook Islands, New Caledonia) these categories should be added.

In general, where good and comprehensive data exists 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 DevFish studies are in this category (e.g. Philipson 2006; Philipson 2007; 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 (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 in prices.
- The difficulty of estimating prices. Typically, prices for fish vary widely by fish size, species, product form, season, and market so that 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, the 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 the difficulties with 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: (i) value of gross output of fishing, and (ii) 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 are thus 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 vessel 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 (i) the records of development banks and other financial institutions, (ii) surveying the sector, (iii) published reports on the sector including studies into the benefit/cost of proposed development projects, and (iv) 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: (i) those that involve motorised boats, and (ii) those that do not. The 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 the non-motorised activities to be less than 90%. In contrast, the motorised subsistence fishing activities range from high-cost trolling to medium- and low-cost bottom-fishing. Estimating the value added ratio of the 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 the 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 over-all 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% to 55%
Small-scale commercial fishing	55% to 70%
Subsistence	
non-motorized	90%
motorized	65% to 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/Lightfoot report stated: "Additional information on the economics of small-scale fisheries would contribute to improving the measurement of the fisheries contribution to GDP". Accordingly, the present study devoted considerable attention to gathering information from which improved VAR 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 was scrutinised and value added ratios were calculated.

Table A3-1: Value added Ratios from Recent 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 (2007); study carried 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 to 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 hp to 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 to 0.79
	Small boat fishing in New Caledonia; outboard vessels 3.4 to 4.5 m in length	Dupont et al. (2004); data from 2002 to 2004	0.65
	Small boat fishing in New Caledonia; outboard vessels 5.5 to 5.5 m in length	Dupont et al. (2004); data from 2002 to 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 to 0.72
	"Artisanal fishing" in Fiji	Reddy (2004); data from June 2003 to January 2004	0.51

Table A3-1: continuation

Category	Activity/Location	Source/Date	VAR
Fishing from vessels larger than 7 meters	Small boat fishing in New Caledonia; inboard vessels 7 to 8 m in length	Dupont et al. (2004); data from 2002 to 2004	0.65
	Small boat fishing in New Caledonia; inboard vessels 8.4 to 11.96 m in length	Dupont et al. (2004); data from 2002 to 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 comm.., November 2008)	0.452 to 0.508
	Pearl culture in the Cook Islands, 30% technician paid locally	R.Newnham (personal comm., October 2008); Years 2005 and 2006	0.41 (2005) 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

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 to 2007 the FFA/SPC 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 2007; 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 Report

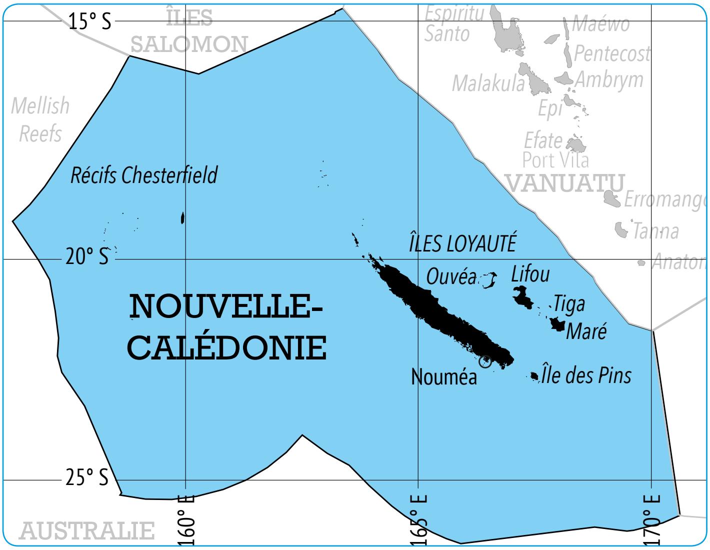
In view of the above studies and experience gained from Gillett and Lightfoot (2001), in this report the value added ratios in Table A3-2 below are generally used. Some judgment is, however, required in using the VARs. Depending on the national situation, the mix of fishing activities, and associated intermediate costs of those activities, the value added ratios used in herein vary somewhat from Table A3-2.

Table A3-2: Value Added Ratios Used in this Report

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 to 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

Version française
des chapitres relatifs
aux Territoires français
du Pacifique

Appendix 4: Nouvelle-Calédonie



A4.1 Volume et valeur des captures de poisson en Nouvelle-Calédonie

Captures des pêcheurs professionnels côtiers en Nouvelle-Calédonie

La production halieutique côtière de la Nouvelle-Calédonie a déjà fait l'objet de plusieurs tentatives d'évaluation :

- 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) ont réalisé une estimation de la production annuelle en 2002 et 2003 : a) pêche professionnelle lagonaire et côtière : 1 200 tonnes, 238 unités, 492 pêcheurs ; b) prises destinées à l'autoconsommation (pêche vivrière et plaisancière) : 3 500 tonnes.
- À partir des estimations de 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 (2009) 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 (francs Pacifique) à la première vente ; b) production de la pêche côtière vivrière : 3 500 tonnes, soit 1,372 milliard de francs CFP valeur départ pêcheur.

On peut raisonnablement penser que les statistiques de la Direction des affaires maritimes (DAM) relatives aux captures déclarées par les pêcheurs professionnels sont proches de la réalité. En revanche, le travail d'estimation de la production halieutique côtière globale se complique lorsque l'on tente d'extrapoler la production totale de la filière professionnelle à partir de la production commerciale déclarée, ou que l'on souhaite estimer les captures de la pêche côtière vivrière et plaisancière. Aux yeux des agents des services des pêches et des acteurs du secteur rencontrés en Nouvelle-Calédonie, le rapport de Dupont *et al.* (2004), qui fait la synthèse d'une grande variété de données relatives à la pêche, reste probablement la source d'information de référence sur la production halieutique globale du Territoire.

Au cours des dix années écoulées depuis l'étude de Dupont *et al.* (2004), les agents des services des pêches territoriaux et provinciaux n'ont pas constaté d'évolution significative de la production halieutique côtière (R. Etaix-Bonnin et T. Tiburzio, communication personnelle, août 2015). Les épisodiques fluctuations résultant du fléchissement du cours du nickel et de la flambée des prix du carburant peuvent être qualifiées de négligeables.

Cette vision d'une production halieutique côtière stable est confortée par les statistiques de la DAM concernant les captures déclarées par les pêcheurs professionnels, qui sont restées raisonnablement constantes depuis l'étude de Gillett (2009). Elles font état d'une production récifo-lagonaire totale de 569 tonnes en 2008 et de 544 tonnes en 2013 (dernière année pour laquelle des statistiques ont été publiées) (DAM 2014).

On constate en revanche que les prix ont augmenté. Les données de la DAM (2014) montrent que la valeur totale des captures déclarées de la pêche récifo-lagonaire a progressé de 21 % entre la publication des travaux de Gillett (2009) et 2013.

Sur la base de ces données publiques relatives à la production halieutique côtière de la Nouvelle-Calédonie, il semble que la méthode la mieux adaptée pour procéder à une estimation de la production globale consiste à partir du postulat d'une production dont le volume est resté stable depuis l'étude de Gillett (2009), mais dont la valeur s'est appréciée de 21 %. En suivant cette logique on peut estimer qu'en 2014 : a) la production de la pêche côtière professionnelle s'est établie à 1 350 tonnes, soit une valeur de 915 millions de francs CFP à la première vente ; et b) les captures de la pêche côtière vivrière ont totalisé 3 500 tonnes, soit une valeur départ pêcheur de 1,66 milliard 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.

En utilisant la méthode adoptée plus haut pour la pêche professionnelle côtière, nous posons l'hypothèse d'un volume inchangé de la production côtière vivrière depuis l'étude de Gillett (2009), associé à un renchérissement de sa valeur à hauteur de 21 %.

La production de la pêche vivrière en Nouvelle-Calédonie en 2014 est donc estimée à 3 500 tonnes, soit une valeur départ pêcheur de 1,66 milliard de francs CFP.

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, présence d'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. 2015) fournit les informations suivantes :

> C'est à partir de 1981 que des canneurs néo-calédoniens (moins de trois unités) ont entrepris de cibler les ressources thonières et associées, mais ils ont très vite cessé leur activité (1981 : 228 tonnes ; 1982 : 998 tonnes ; 1983 : 492 tonnes).Quelques

palangriers ont également commencé à opérer à la même époque, mais il a fallu attendre encore une vingtaine d'années pour que cette flottille domestique prenne une dimension substantielle. Elle pêche dans la ZEE du Territoire et s'aventure rarement dans la haute mer adjacente. En 2014, la totalité des 17 palangriers licenciés étaient en activité. Tout comme c'était le cas lors des années précédentes, on ne comptait aucun navire étranger détenteur d'une licence de pêche ou affrété pour opérer dans la ZEE de Nouvelle-Calédonie.

Tableau A4-1 : Captures des unités de pêche hauturière locales (tonnes)

	2012	2013	2014
Germon	1 751	1 732	1 630
Thon jaune	573	531	741
Thon obèse	41	51	58
Marlin	154	104	123
Espadon	10	9	14
Requin mako	10	2	0
Autres	260	261	310
Total	**2 796**	**2 691**	**2 876**

Source : DAM (2014) et Anon. (2015)

Le rapport annuel de la DAM sur la pêche hauturière (DAM 2014) apporte des informations sur la valeur des captures et indique qu'en 2013 le chiffre d'affaires de la filière à la première vente s'établissait à 1,135 milliard de francs CFP (soit 420 francs CFP/kg). Le rapport annuel concernant l'année 2014 n'était pas disponible en décembre 2015. Toutefois, les chiffres fournis par l'Institut de la statistique et des études économiques de Nouvelle-Calédonie (ISEE 2015) indiquent qu'en 2014, la valeur à l'exportation des prises de la filière hauturière avait augmenté de 16 % par rapport à l'année précédente. Nous allons donc, aux fins de la présente étude, partir de l'hypothèse d'une progression de la valeur totale des captures de 16 %.

Les captures des unités de pêche hauturière locales pour 2014 sont estimées à 2 876 tonnes, soit 1 316 600 000 francs CFP.

Captures des unités de pêche hauturière battant pavillon étranger

Dans le document présenté par la Nouvelle-Calédonie à la quatrième réunion du Comité scientifique de la Commission des pêches du Pacifique occidental et central (Anon. 2008), il est indiqué qu'aucune licence n'a été délivrée à des bateaux de pêche étrangers depuis début 2001. L'absence de bateaux de pêche battant pavillon étranger autorisés à pêcher dans les eaux du Territoire au cours des dernières années a été confirmée en août 2015 dans le document présenté à la onzième réunion du Comité scientifique (Anon. 2015).

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 DAM, 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, août 2015).

On peut estimer à approximativement 10 tonnes le volume des captures annuelles. En adoptant la même méthode que pour la pêche côtière vivrière, on peut évaluer cette production à 4,743 millions de francs CFP.

Production aquacole

L'aquaculture néo-calédonienne est dominée par la crevetticulture. On élève également, à une échelle bien plus modeste, des huîtres gigas et des écrevisses d'eau douce. On signale par ailleurs quelques tentatives expérimentales d'élevage de picot et d'holothurie.

C'est au début des années 80 que la crevetticulture a démarré en Nouvelle-Calédonie. La production a fortement progressé jusqu'en 2006, avant de reculer jusqu'en 2010, puis de repartir quelque peu à la hausse. Environ 60 % de la production est exportée, dont les trois quarts vers le marché japonais.

- Le rapport annuel sur la pêche professionnelle et l'aquaculture (DAM 2014) indique qu'en 2013, on comptait 18 élevages de crevettes, 94 bassins et 670 hectares en exploitation. La production s'élevait à 1 570 tonnes, pour un prix moyen à la première vente de 1 050 francs CFP/kg (soit une valeur globale de 1 648 500 000 francs CFP).

- Le rapport annuel 2014 n'était pas publié en décembre 2015, mais les données de l'ISEE (2015) indiquent que la production de crevettes pour l'année 2014 s'élevait à 1 670 tonnes. Sur la base des prix à la première vente de 2013, on peut estimer la valeur de la production de 2014 à environ 1 753 500 000 francs CFP.

La production annuelle d'écrevisses d'eau douce se situe entre 3 et 4 tonnes, alors que celle des huîtres gigas oscille 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.

La production aquacole totale de la Nouvelle-Calédonie en 2014 était estimée à 1 733 tonnes, soit une valeur à la première vente de 1 843 500 000 francs CFP.

Synthèse des captures

Le tableau A4-2 présente une approximation 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 2014.

Tableau A4-2 : Production annuelle de la pêche et de l'aquaculture en Nouvelle-Calédonie en 2014

Type de pêche	Volume (en tonnes)	Valeur (CFP)
Côtière professionnelle	1 350	915 000 000
Côtière vivrière	3 500	1 660 000 000
Hauturière locale	2 876	1 316 600 000
Hauturière étrangère	0	0
Eau douce	10	4 743 000
Aquaculture	1 733	1 843 500 000
Total	**9469**	**5 739 843 000**

L'auteur reconnaît que les données sous-tendant les estimations relatives à la pêche côtière professionnelle et vivrière sont insuffisantes.

Les figures A4-1 et A4-2 illustrent le volume et la valeur de la production halieutique en Nouvelle-Calédonie en 2014.

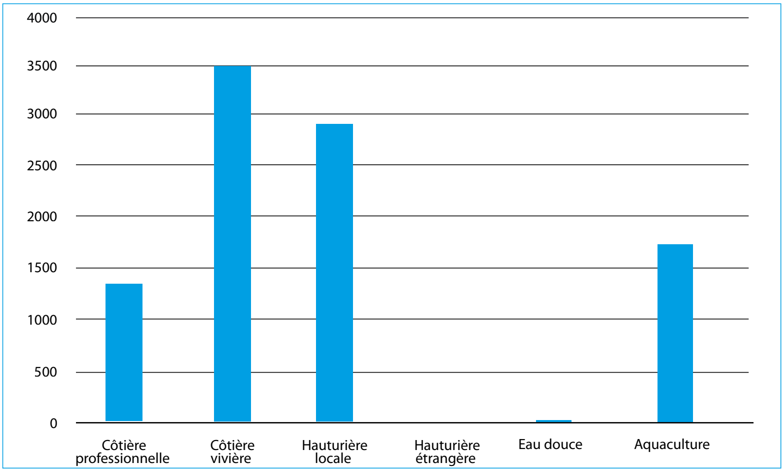


Figure A4-1 : Volume de la production halieutique en Nouvelle-Calédonie en 2014 (exprimé en tonnes)

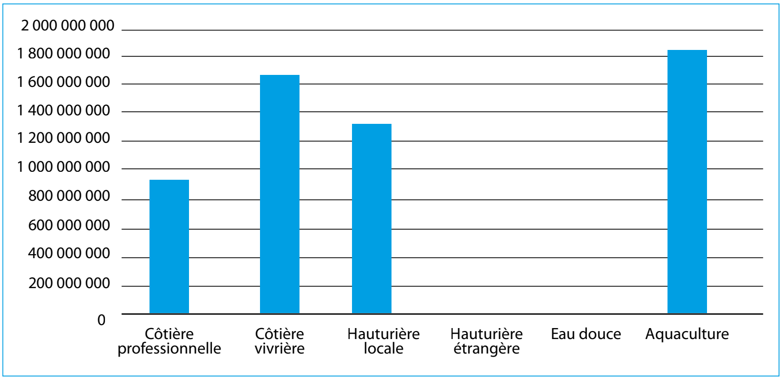


Figure A4-2 : Valeur de la production halieutique en Nouvelle-Calédonie en 2014 (exprimée en francs CFP)

Niveaux historiques de la production halieutique : estimations des précédentes études Benefish

Un certain nombre d'études portant sur les retombées de la pêche dans les États et Territoires océaniens (Études Benefish) ont déjà été réalisées. Gillett et Lightfoot (2001) se sont intéressés à l'année 1999, Gillett (2009) à 2007, tandis que la présente étude porte sur l'année 2014. Les niveaux de la production halieutique de Nouvelle-Calédonie estimés à partir de ces trois études sont reproduits au tableau A4-3 .

Tableau A4-3 : Estimations de la production annuelle de la pêche et de l'aquaculture issues des études Benefish

Type de pêche	Année	Volume (tonnes et pièces, le cas échéant)	Valeur nominale (CFP)
Côtière professionnelle	1999	s/o	s/o
	2007	1 350	756 000 000
	2014	1 350	915 000 000
Côtière vivrière	1999	s/o	s/o
	2007	3 500	1 372 000 000
	2014	3 500	1 660 000 000
Hauturière locale	1999	s/o	s/o
	2007	2 122	745 000 000
	2014	2 876	1 316 600 000
Hauturière étrangère	1999	s/o	s/o
	2007	0	0
	2014	0	0
Eau douce	1999	s/o	s/o
	2007	10	3 992 000
	2014	10	4 743 000
Aquaculture	1999	s/o	s/o
	2007	1 931	1 443 700 000
	2014	1 733	1 843 500 000

Source : présente étude, Gillett (2009), Gillett et Lightfoot (2001)

Les variations de la production que l'on constate entre ces années correspondent pour partie à une véritable évolution de la production, mais peuvent également s'expliquer par l'adoption d'une méthode nouvelle (que l'on peut espérer meilleure) de mesure de cette même production. Dans le tableau ci-dessus, les niveaux annuels de production des pêches côtière commerciale, côtière vivrière et d'eau douce restent inchangés quelle que soit l'étude considérée, car il n'existe pas de nouveaux chiffres ou de données empiriques pointant un changement. 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

Le dernier calcul officiel et détaillé du PIB de la Nouvelle-Calédonie concerne l'année 2010. Bien que certaines estimations provisoires aient été établies jusqu'en 2013, la contribution détaillée de chaque secteur d'activité n'a pas encore été rendue publique.

Des données non publiées fournies par les agents de l'ISEE permettent de déterminer la part de la pêche et de l'aquaculture dans le PIB de la Nouvelle-Calédonie pour l'année 2010 exprimé en francs courants (tableau A4-4).

Tableau A4-4 : Contribution de la pêche et de l'aquaculture au PIB de Nouvelle-Calédonie en 2010

	Valeur de la production	Valeur ajoutée
Pêche	4 155	1 236
Aquaculture	1 738	127
Total pêche et aquaculture	5 893	1 363

Source : ISEE (données non publiées)

Le PIB de l'année 2010 s'élevant à 842,913 milliards de francs CFP (ISEE 2014), la part de la pêche et de l'aquaculture correspond à environ 0,16 % du total.

Méthode de calcul de la contribution officielle de la pêche au PIB

Des entretiens, suivis d'un échange de correspondance, avec les agents de l'ISEE ont permis de mieux comprendre la méthode de calcul de la contribution de la pêche et de l'aquaculture au PIB (L. Bertoux, communication personnelle, octobre 2015), dont voici les grands principes :

- S'agissant de l'aquaculture, les chiffres de la production et de la consommation intermédiaire sont issus des déclarations des entreprises servant au calcul de l'impôt sur les sociétés.
- Les données relatives à la pêche professionnelle proviennent de la DAM.
- La production de la pêche non professionnelle est estimée à 3 500 tonnes par an, chiffre dérivé de l'enquête Budget Consommation des ménages réalisée en 1998.

L'examen du tableau ci-dessus permet de déterminer les coefficients de valeur ajoutée appliqués à la pêche (0,30) et à l'aquaculture (0,07). Or, ces niveaux semblent faibles a priori. Toutefois, l'ISEE ayant accès aux comptes des entreprises aquacoles, on peut partir du principe que, même s'il paraît peu élevé, ce coefficient de valeur ajoutée correspond à la réalité du secteur. En revanche, il y a tout lieu de penser que le coefficient appliqué à la pêche n'est pas réaliste, l'essentiel de la production halieutique entrant dans la catégorie de la pêche vivrière, à laquelle est typiquement associé un coefficient de valeur ajoutée élevé. Dans la présente étude, nous appliquons un coefficient de valeur ajoutée de 0,80 à 0,90 à la pêche vivrière en mer. Dupont *et al.* (2004) ont travaillé sur les coefficients de valeur ajoutée en Nouvelle-Calédonie et les résultats de leurs travaux sont présentés au tableau A4-5.

Tableau A4-5 : Coefficients de valeur ajoutée associés à certains types de pêche en Nouvelle-Calédonie

Activité/Lieu	Coefficient de valeur ajoutée
Pêche à bord de petites embarcations en Nouvelle-Calédonie ; bateaux à moteur hors-bord de 3,4 à 4,5 m de longueur	0,65
Pêche à bord de petites embarcations en Nouvelle-Calédonie ; bateaux à moteur hors-bord de 5,5 à 7 m de longueur	0,80
Pêche à bord de petites embarcations en Nouvelle-Calédonie ; bateaux à moteur inboard de 7 à 8 m de longueur	0,65
Pêche à bord de petites embarcations en Nouvelle-Calédonie ; bateaux à moteur inboard de 8,4 à 11,96 m de longueur	0,60

Source : information extraite de Dupont *et al.* (2004)

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 production a été établie dans la section A4.1 (et récapitulée au tableau A4-2), et à déterminer la valeur ajoutée à l'aide de coefficients de valeur ajoutée correspondant au type de pêche concerné. Ces coefficients sont établis sur la base de la connaissance du secteur halieutique et d'études spécialisées (annexe 3).

On peut procéder à l'évaluation de la contribution au PIB (tableau A4-6) en appliquant ces coefficients de valeur ajoutée à la valeur de la production des différents types de pêche et d'aquaculture pratiqués en Nouvelle-Calédonie (détaillés au tableau A4-5 ci-dessus).

Tableau A4-6 : Contribution de la pêche au PIB en 2014 calculée au moyen d'une autre méthode

Type de pêche	Valeur brute de la production (en CFP, reprise du tableau A4-2)	Coefficient de valeur ajoutée	Valeur ajoutée (CFP)
Côtière professionnelle	915 000 000	0,65	594 750 000
Côtière vivrière	1 660 000 000	0,80	1 328 000 000
Hauturière locale	1 316 600 000	0,20	263 320 000
Eau douce	4 743 000	0,90	4 268 700
Aquaculture	1 843 500 000	0,45	829 575 000
Total (CFP)	**5 739 843 000**	---	**3 019 913 700**

Source : tableau A4-2 ci-dessus, et les 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.

En 2013, le PIB de la Nouvelle-Calédonie s'élevait à 886 milliards de francs CFP (ISEE 2014). S'il est manifestement quelque peu hasardeux, sur le plan méthodologique, de comparer la valeur ajoutée issue de la pêche et de l'aquaculture en 2014 au PIB de 2013, on remarquera toutefois, à titre indicatif, que le poids du secteur de la pêche et de l'aquaculture en 2014 correspond à 0,34 % du PIB de l'année précédente, c'est-à-dire quasiment le double de la contribution officielle de la filière au PIB en 2010. Cet écart s'explique pour l'essentiel par les coefficients de valeur ajoutée relativement faibles utilisés dans les calculs officiels.

A4.3 Exportations

L'ISEE suit l'évolution des exportations de la Nouvelle-Calédonie, dont celles des produits de la pêche : les données ainsi recueillies relatives à la valeur et au volume de ces exportations sont présentées respectivement aux tableaux A4-7 et A4-8.

Tableau A4-7 : Valeur des exportations de produits de la pêche pour la Nouvelle-Calédonie (exprimée en millions de francs CFP)

	2010	2011	2012	2013	2014
Tous les produits de la pêche	1 806	1 832	1 942	2 053	2 173
Thon	431	437	413	265	253
Crevette	1 025	1 013	1 145	1 302	1 435
Bêche-de-mer	181	287	260	342	389
Coquille de troca	104	68	86	106	61
Autre	65	27	38	38	35
Total des exportations de la Nouvelle-Calédonie	134 530	143 904	123 039	110 189	144 309
% des exportations des produits de la pêche	1,3 %	1,3 %	1,6 %	1,9 %	1,5 %

Source : ISEE (2015), modifié

Tableau A4-8 : Volume des exportations de produits de la pêche pour la Nouvelle-Calédonie (exprimé en tonnes)

	2010	2011	2012	2013	2014
Tous les produits de la pêche	2 131	1 749	1 834	1 943	1 793
Thon	1 095	844	779	775	636
Crevette	746	708	817	868	958
Bêche-de-mer	26	34	31	42	52
Coquille de troca	228	144	175	227	127
Autre	36	19	32	31	20

Source : ISEE (2015), modifié

La lecture des tableaux ci-dessus montre que la crevette arrive largement en tête des exportations de produits de la pêche et que le volume de ces exportations a augmenté au cours des cinq années prises en compte. La bêche-de-mer se situe en deuxième position, mais les ventes de ce produit à l'exportation ont diminué au cours de la même période.

Contrairement à ce que l'on constate dans d'autres États et Territoires insulaires océaniens dotés d'une flottille locale de palangriers, la majorité des thons capturés en Nouvelle-Calédonie n'est pas exportée, mais consommée sur place. En 2014, le quart seulement des captures de thon a été exporté. La production de crevettes d'élevage est quant à elle exportée à hauteur de 57 %.

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. 2008). De ce fait, aucune redevance n'a été perçue à ce titre.

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. De nombreuses aides financières sont prévues pour les différents sous-secteurs de la pêche.

A4.5 Emploi

La Nouvelle-Calédonie dispose de données de qualité sur les emplois occupés à bord des unités de pêche hauturière locales, ainsi que dans le cadre des activités associées à terre. On trouve également des données sur les pêcheurs professionnels patentés (immatriculés) et sur les employés de l'aquaculture déclarés, mais les informations relatives aux pêcheurs professionnels non déclarés et aux pratiquants de la pêche vivrière sont beaucoup plus clairsemées.

L'ISEE (2015) fait la synthèse des données disponibles relatives aux pêcheurs professionnels patentés (tableau A4-9).

Tableau A4-9 : Nombre de pêcheurs professionnels patentés[1]

	2000	2005	2010
Pêche côtière et pêche lagonaire	**694**	**412**	**613**
Province Sud	348	172	92
Province Nord	286	149	480
Province Îles Loyauté	60	91	41
Pêche hauturière	**99**	**162**	**120**
Province Sud	99	102	93
Province Nord	0	60	27
Total pêche côtière/lagonaire/hauturière	793	574	733

Source : ISEE (2015)

Le rapport DAM (2011) examine plus en détail la situation de l'emploi dans la filière hauturière et convertit le nombre d'emplois en équivalents temps plein (ETP) (tableau A4-10). Si la présentation des données en ETP permet de réaliser des comparaisons entre les années et les pays, il faut savoir qu'en dehors de la Nouvelle-Calédonie, cette méthode est très peu (voire pas du tout) utilisée par les États et Territoires visés dans la présente étude.

1 D'après un spécialiste ayant une bonne connaissance du secteur de la pêche en Nouvelle-Calédonie, on compte autant de professionnels non déclarés que de pêcheurs patentés (B. Fao, communication personnelle, août 2008).

Tableau A4-10 : Emplois de la filière hauturière en 2010

		Nombre d'emplois	Équivalents temps plein
EMBARQUÉS	Capitaines	10	9,5
	Capitaines-mécaniciens	14	12,1
	Mécaniciens	6	6,0
	Hommes d'équipage	94	80,3
	Total	**124**	**108,7**
A TERRE	Chefs d'armement	7	6,4
	Adjoints au chef d'armement	4	3,3
	Secrétaires	4	2,6
	Comptables	5	2,4
	Responsables techniques	1	1,0
	Techniciens de maintenance	9	9,0
	Personnel de débarquement	3	3,0
	Personnel d'entretien	1	0,5

N. B. : les chiffres correspondent au nombre d'emplois occupés
Source : DAM (2011)

Une étude plus récente (DAM 2014) renferme des données actualisées et plus détaillées sur l'emploi dans la filière hauturière. D'après ces estimations, on comptabilisait en 2013 120 marins, 30 personnes à terre employées par les armements de pêche, 60 personnes dans les ateliers de transformation et une vingtaine de personnes chez les grossistes, ce qui représente 230 emplois au total.

L'ISEE dispose de données non publiées sur l'emploi, obtenues à partir des registres du personnel des entreprises (tableau A4-11). Il est à supposer que ces données correspondent au nombre de salariés déclarés dans le secteur de la pêche. Ces données incluent également les emplois dans l'aquaculture.

Tableau A4-11 : Nombre d'emplois dans le secteur de la pêche, calculés à partir des registres du personnel des entreprises

	2010	2011	2012	2013	2014
Pêche en mer	228	249	245	238	228
Pêche en eau douce	0	0	0	0	0
Aquaculture marine	154	169	170	190	199
Aquaculture d'eau douce	0	0	0	0	0
Total	**382**	**417**	**415**	**428**	**426**

Source : ISEE (données non publiées)

Le site Internet de l'ISEE [2] indique que la Nouvelle-Calédonie comptabilisait 91 440 salariés en 2014. Les 426 personnes employées dans le secteur de la pêche (voir tableau ci-dessus) représentent donc 0,47 % des salariés du Territoire.

On dispose par ailleurs des données suivantes sur l'âge des professionnels de la pêche :

- Une enquête réalisée par la Province Sud montre qu'en 2013, la moyenne d'âge des 82 capitaines d'unités de pêche s'élevait à 52 ans, sachant que 30 % d'entre eux étaient âgés de plus de 60 ans et 43 % de moins de 50 ans (Province Sud 2014).
- Une étude réalisée en 2013 indique 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).

Les données relatives à la pêche non professionnelle sont moins abondantes. Virly (2000) présente les résultats d'une enquête relative à la pêche vivrière, qui a notamment consisté à administrer un questionnaire auprès d'un échantillon de 1 000 personnes dans les trois provinces du Territoire. Les résultats obtenus montrent que la moitié des personnes interrogées pêchait une à trois fois par semaine.

Dans le cadre du programme ProcFish de la CPS, cinq sites ont été étudiés en Nouvelle-Calédonie (Kronen *et al.* 2009). Le tableau A4-12 est extrait du rapport correspondant et montre l'importance de la pêche récifale et de la vente de poissons. Les sites en question n'avaient pas pour vocation d'être représentatifs de l'ensemble des sites du Territoire, mais de ceux où la pêche récifale est activement pratiquée.

2 http://www.isee.nc/economie-entreprises/entreprises-secteurs-d-activites/agriculture-peche-aquaculture [consulté le 8 avril 2016]

Tableau A4-12 : Participation à la pêche sur les sites ProcFish de la CPS

Site	Foyers participant à la pêche récifale	Foyers dont la pêche est la principale source de revenu
Ouassé	100 %	0 %
Thio	97,6 %	47,6 %
Luengoni	90,0 %	6,7 %
Oundjo	100 %	50,0 %
Moindou	90,0%	12,5%
Moyenne des 5 sites	94,6 %	27,0 %

Source : Kronen *et al.* (2009)

La CPS (2013) s'appuie sur les données issues du programme ProcFish pour déterminer la proportion d'hommes et de femmes chez les pêcheurs en Océanie. Sur les sites étudiés en Nouvelle-Calédonie, on constate qu'environ 65 % des pêcheurs sont des hommes, contre 35 % de femmes.

A4.6 Niveaux de consommation de la ressource halieutique

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 est estimée à 21,6 kg.

Selon un représentant de la DAM, aucune autre étude n'a été réalisée depuis sur la consommation de poisson en Nouvelle-Calédonie (R. Etaix-Bonnin, communication personnelle, août 2015).

Bell *et al.* (2009) ont exploité les données issues des enquêtes sur les revenus et les dépenses des ménages réalisées entre 2001 et 2006 afin de procéder à une estimation de la structure de consommation du poisson dans les pays océaniens. Ces enquêtes avaient été conçues pour déterminer quelle part de la consommation était attribuable 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'élève à 25,6 kg. La consommation annuelle par habitant est estimée à 54,8 kg dans les zones rurales, contre 10,7 kg en zone urbaine.

Dans le cadre du programme ProcFish de la CPS, cinq sites ont été étudiés en Nouvelle-Calédonie (Kronen *et al.* 2009). Ce travail inclut des estimations de la consommation de poisson par habitant (tableau A4-13). Les sites en question n'avaient pas pour vocation d'être représentatifs de l'ensemble des sites du Territoire, mais de ceux où la pêche récifale est activement pratiquée. Par rapport à d'autres sites étudiés dans le cadre du programme ProcFish en Océanie, la consommation nominale d'invertébrés par habitant apparaît relativement importante, et elle est même très élevée si on la compare à la consommation de poisson frais sur les sites étudiés en Nouvelle-Calédonie.

Tableau A4-13 : Consommation de produits de la pêche sur les sites ProcFish (kg/personne/an)

Site	Consommation de poisson frais	Consommation d'invertébrés	Consommation de poisson en conserve
Ouassé	20,74	14,25	5,36
Thio	21,57	34,99	4,68
Luengoni	36,21	5,25	18,05
Oundjo	34,39	46,12	5,82
Moindou	32,95	23,47	1,17
Moyenne des 5 sites	29,81	26,46	6,69

Source : Kronen *et al.* (2009)

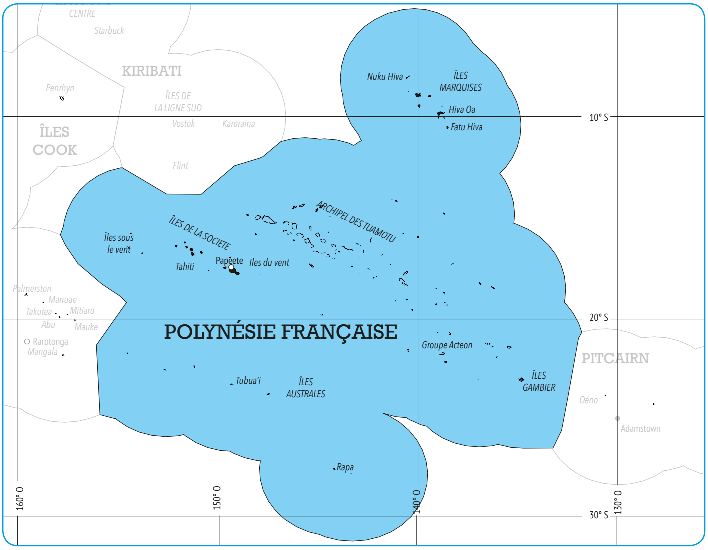
La consommation locale de poisson est alimentée par une filière relativement nouvelle. La pêche à la palangre a fait son apparition en Nouvelle-Calédonie au début des années 80. Au milieu des années 90, on ne comptait plus que deux unités en exercice (DAM 2013). En 2014, la flottille (qui comptabilise alors 17 bateaux) a capturé 2 876 tonnes de thon et autres poissons pélagiques (Anon. 2015), dont seulement 253 tonnes ont été écoulées sur le marché à l'exportation (ISEE 2015). Les 2 624 tonnes restantes représentent environ 26,2 kg de poisson pour chacun des 100 000 habitants de Nouméa .

A4.7 Taux de change

Les taux de change annuels moyens (dollar É.-U. en francs CFP) utilisés dans le présent rapport sont les suivants :

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
96	96	95	87	80.0	83,22	90,27	92,16	89,88	86,01	98,13

Appendix 5: Polynésie française



A5.1 Volume et valeur des captures de poisson en Polynésie française

Captures des pêcheurs professionnels côtiers en Polynésie française

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.).

Les bulletins statistiques de la Direction des ressources marines et minières (DRMM), service territorial chargé de la pêche, présentent un tableau raisonnablement complet de la production halieutique de la Polynésie française. Ce sont donc ces données que Gillett (2009) a utilisées en 2009, en les adaptant aux catégories sélectionnées pour sa propre étude. Il a ainsi estimé qu'en 2007, la production de la pêche côtière professionnelle de Polynésie française s'établissait à 4 002 tonnes (soit une valeur départ pêcheur de 2 milliards de francs CFP (franc Pacifique)) et celle de la pêche côtière vivrière à 2 880 tonnes (soit 1,15 milliard de francs CFP départ pêcheur).

Les données relatives à la pêche côtière disponibles aux fins de la présente étude étant analogues à celles auxquelles Gillett avait eu accès en 2009, il a été décidé de suivre une démarche semblable pour estimer la production de la pêche côtière.

La DRMM décompose la pratique de la pêche en Polynésie française en trois catégories : lagonaire, côtière et hauturière. Dans cette classification, la pêche dite « côtière »[1] ne correspond pas à la définition adoptée aux fins de la présente étude : la DRMM 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 définies par la DRMM correspondent à la combinaison des catégories de la pêche côtière professionnelle et de la pêche côtière vivrière définies dans la présente étude.

On apprend à la lecture du Bulletin statistique de la DRMM (DRMM 2015) qu'en dépit de l'absence de statistiques fiables sur les produits lagonaires, il est possible d'estimer la production globale polynésienne pour l'année 2014 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.

Ces données sont extraites de l'édition 2014 du bulletin statistique annuel de la DRMM, mais on les retrouve reproduites à l'identique dans tous les rapports de la DRMM depuis au moins 2007. Il semble que ces statistiques résultent de l'exploitation sélective d'une série d'études relatives aux différentes zones géographiques de Polynésie française.

D'après les agents de la DRMM, la production de la pêche lagonaire n'a pas connu d'évolution significative au cours des dix dernières années. Ils évoquent un certain nombre de facteurs qui auraient pu avoir une incidence sur la production, mais dont l'impact s'est révélé négligeable :

- Les captures de poissons pélagiques par les palangriers ont une forte incidence sur la production de la pêche côtière. L'augmentation de la

1 « Pêche côtière » dans le Bulletin statistique de la DRMM.

production palangrière engendre en effet une baisse de la demande en ressources halieutiques récifales et lagonaires.

- Il est désormais de plus en plus facile de transporter du poisson par avion depuis l'archipel des Tuamotu (où se déroulent une bonne partie des activités de la pêche côtière) vers Tahiti (où l'essentiel de la production halieutique côtière est consommé).
- Les fluctuations de la production perlicole (essentiellement dans les Tuamotu) se font ressentir sur le niveau de la production halieutique côtière, puisqu'il n'existe pratiquement pas d'autre secteur pourvoyeur d'emplois dans cette région. Après avoir atteint des niveaux record en 2000, la production du secteur perlicole a pratiquement diminué de moitié. La progression de la production halieutique côtière attribuable à la reconversion de certains employés du secteur perlicole se heurte toutefois au niveau d'exploitation déjà optimal (voire même à la surexploitation) de la ressource sur certaines îles.
- Les pièges à poissons traditionnels (« parcs à poissons ») comptant pour environ la moitié de la production totale de la pêche côtière, toute modification du nombre de ces dispositifs est susceptible de fortement influer sur la production. Le nombre de parcs n'a que faiblement augmenté aux Tuamotu et aux îles Sous-le-Vent dans l'archipel de la Société. La destruction de nombreux parcs à poissons de Polynésie française en 2010 et 2011, sous l'effet d'une houle exceptionnelle, ne semblerait avoir eu qu'un impact relativement négligeable sur la production, les grands exploitants ayant rapidement procédé à la réparation de leurs dispositifs. Les petits producteurs ont quant à eux été plus touchés, car ils n'ont pas pu remettre leurs parcs en état aussi rapidement.
- De 2013 à 2015, un navire était dédié à la collecte du poisson. L'impact sur la production de sa mise en service puis de l'arrêt de son exploitation est considéré comme mineur, sa contribution à la production pendant cette période n'ayant pas été significative.

Les éléments répertoriés ci-dessus ont eu des effets positifs aussi bien que négatifs sur la production halieutique. Globalement, on peut en conclure que la production halieutique côtière est restée relativement stable au cours des dix dernières années. Cet avis est d'ailleurs partagé par l'ensemble des acteurs locaux ayant une bonne connaissance du secteur. En conséquence, nous partons ici du principe que la production lagonaire annuelle du

Territoire s'est bien maintenue au niveau fréquemment mentionné de 4 300 tonnes. Il convient toutefois de prendre acte d'un changement signalé par les responsables de la DRMM : la part de la production lagonaire commercialisée a augmenté pour atteindre un niveau désormais quasiment équivalent à celui des captures de la pêche vivrière (A. Stein et C. Ponsonnet, communication personnelle, septembre 2015). On estime donc que les 4 300 tonnes de captures de la pêche lagonaire reviennent pour 2 150 tonnes à la pêche professionnelle et 2 150 tonnes à la pêche vivrière.

Si l'on évalue la production vivrière sur la base du « prix à la production » (qui consiste à appliquer une réduction de 30 %), on peut déterminer la valeur et le volume de la production lagonaire professionnelle et vivrière pour l'année 2014. Bien que la valeur déclarée de la pêche lagonaire figurant dans les rapports de la DRMM soit restée constante (2 milliards de francs CFP) depuis 2007, on peut raisonnablement supposer qu'elle a progressé, ne serait-ce que légèrement, au cours de ces dix années. En conséquence, les captures de 2 150 tonnes de la pêche professionnelle lagonaire sont estimées à 1 470 588 235 francs CFP valeur départ pêcheur et les 2 150 tonnes de captures non professionnelles à 1 029 411 764 francs CFP valeur départ pêcheur pour 2014.

Pour obtenir le volume total des captures de la pêche côtière professionnelle en Polynésie française, il convient d'ajouter la production lagonaire susmentionnée aux prises de la flottille des bonitiers et des poti marara. Il convient de préciser la nature de ce type de pêche (qualifiée de « pêche côtière » dans les statistiques officielles), afin d'éviter une possible confusion avec la catégorie de la « pêche côtière professionnelle » utilisée dans la présente étude. On apprend dans DRMM (2015) que :

> La flottille de pêche côtière professionnelle se compose de 2 types d'embarcations : les *poti marara* (littéralement « bateaux poissons volants ») qui sont de petits bateaux dont la longueur varie de 6 à 8 mètres, construits en bois ou en fibre de verre, et propres à une multitude de techniques de pêche (pêche à la traîne, palangre verticale ou pêche au harpon), opérant dans la zone côtière à environ 15 milles nautiques des côtes, et les bonitiers, dont la taille est comprise entre 10 et 12 mètres, faits de bois ou de fibre de verre et qui ciblent la bonite en pratiquant la pêche à la canne.

La DRMM (2015) indique qu'en 2014, la flottille côtière (45 bonitiers et 448 *poti marara*) a capturé 3 516 tonnes de poisson, 568 tonnes revenant aux bonitiers et 2 948 tonnes aux poti marara. Sur la base d'une valeur départ pêcheur moyenne de 721 francs CFP/kg, la valeur de la production de la flottille côtière en 2014 s'est élevée à 2 535 036 000 francs CFP.

Le volume des captures et la valeur de la production de la pêche côtière professionnelle en Polynésie française en 2014 sont récapitulés au tableau A5-1.

Tableau A5-1 : Pêche côtière professionnelle en Polynésie française en 2014

Type de pêche	Volume (tonnes)	Valeur (XPF)
Pêche professionnelle lagonaire	2 150	1 470 588 235
Bonitiers et *poti marara*	3 516	1 582 000 000
Total	**5 666**	**3 052 588 235**

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, soit une valeur déparwt pêcheur de 1 029 411 764 francs CFP.

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 2008). 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 2014 est estimée à 2 350 tonnes (soit 1 125 171 000 francs CFP, valeur départ pêcheur).

Captures des unités de pêche hauturière locales

La DRMM (2015) fournit les informations suivantes sur la flottille de pêche hauturière locale en 2014 :

- La flottille comptait 62 palangriers, contre 65 en 2013.
- On dénombrait 24 unités d'une longueur inférieure à 16 mètres, 10 unités dont la longueur se situait entre 16 et 20 mètres, et 28 unités d'une longueur supérieure à 20 mètres.

- En 2014, la production totale s'est élevée à 5 390 tonnes, le germon, le thon jaune et le thon obèse représentant 81 % du total des prises.
- Les palangriers équipés de congélateurs ont pris 5 168 tonnes de poissons et les embarcations utilisant de la glace en ont capturé 222 tonnes.

Ces prises représentent une valeur totale de 2,829 milliards de francs CFP (valeur départ pêcheur) (DRMM, données non publiées).

Captures des unités de pêche hauturière battant pavillon étranger

D'après un document présenté par la délégation de Polynésie française à l'occasion de la troisième réunion du Comité scientifique de la Commission des pêches du Pacifique occidental et central, tous les accords d'accès contractés avec des flottilles de pêche étrangères étaient éteints en décembre 2000 (Ponsonnet *et al.* 2007).

Captures en eau douce

Keith *et al.* (2002) s'intéressent aux poissons et aux crustacés d'eau douce de Polynésie française et indiquent que 37 espèces de poissons et 18 espèces de crustacés décapodes sont présentes 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 d'eau douce sur le Territoire, mais les 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 2008).

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 47 879 616 francs CFP.

Production aquacole

En Polynésie française, l'aquaculture est dominée par la perlicuture. On compte aussi une activité importante de crevetticulture, de pisciculture et d'élevage de bénitiers, ainsi qu'une production beaucoup plus limitée de tilapia, de chanos et de picot.

On ne dispose pas de données complètes sur la production des fermes perlicoles de Polynésie française, en raison des sous-notifications et de la non-déclaration des exportations. D'après le Bulletin statistique de la DRMM (DRMM 2015), les éléments suivants étaient établis avec un certain niveau de certitude en 2014 :

- La surface exploitée par la perliculture était de 6 808 hectares, dont 82 % dans les Tuamotu, 16 % aux Gambier et 2 % dans les îles Sous-le-Vent dans l'archipel de la Société.
- On comptait 573 producteurs de perles sur le Territoire, contre 534 en 2006.
- En 2014, 14 578 kg de perles (8 355 000 perles individuelles) d'une valeur FAB de 8,704 milliards de francs CFP ont été exportés.
- La quasi-totalité des produits exportés étaient des perles de culture brutes (98 % en poids ; 99 % en valeur)
- En 2014, 14 341 kg de perles de culture brutes (8 348 000 perles individuelles) ont été exportées, pour une valeur FAB de 8,622 milliards de francs CFP. La valeur FAB au gramme s'élevait à 601 francs CFP.
- Le reliquat des exportations était constitué de keshi, de mabé et de perles travaillées (montées en bijoux).
- Depuis 1972, année du début des exportations de perles de Polynésie française en quantité significative, on a assisté à des variations considérables de la valeur et de la quantité de perles de culture brutes exportées. Les exportations ont atteint leur valeur record en 2000 (20,073 milliards de francs CFP) et leur niveau maximal en 2010 (16 100 kg).
- En 2014, les exportations représentaient environ 41 % de la valeur enregistrée en 2000 et 89 % du volume exporté en 2010.

Pour obtenir une estimation de la production perlicole de la Polynésie française en 2014, ainsi que de la valeur à la production, il convient de poser d'abord un certain nombre d'hypothèses :

- Les exportations déclarées représentent environ 75 % de la production perlicole.
- On peut diminuer les prix FAB de 25 % pour obtenir une estimation approximative du prix à la production.

Sur la base des données fournies par la DRMM sur la production perlicole (mentionnées ci-dessus), ainsi que des hypothèses qui précèdent, on peut estimer la production perlicole du Territoire en 2014 à 14 341 kg de perles brutes (8 348 000 perles individuelles), d'une valeur à la production de 8,622 milliards de francs CFP.

S'agissant des autres activités aquacoles (hors perliculture) pratiquées en Polynésie française en 2014, diverses informations ont pu être recueillies lors d'entretiens avec l'agent chargé de l'aquaculture à la DRMM (G. Remoissenet, communication personnelle, septembre 2015), complétées par la lecture de la DRMM (2015) :

- La production de crevettes *Litopenaeus stylirostris* a atteint 89 tonnes, soit une valeur à la production de 160 millions de francs CFP.
- Les bénitiers destinés à l'exportation sur les marchés de l'aquariophilie sont aussi bien prélevés à l'état sauvage qu'issus du collectage et de l'élevage. D'après l'agent de la DRMM, sur les 33 890 bénitiers exportés en 2014, 13 500 pièces environ provenaient de la filière collectage/élevage, pour une valeur à la production de 3 250 000 francs CFP.
- La production de *Platax orbicularis* (*paraha* en langue tahitienne) a atteint environ 12 tonnes, soit 24 millions de francs CFP.
- Il existe également sur le Territoire des élevages de tilapia, de chanos et de picot, mais les quantités produites sont négligeables par rapport aux produits susmentionnés.

Le tableau A5-2 reprend les données présentées ci-dessus et permet de constater qu'en 2014, la production aquacole de la Polynésie française a atteint 101 tonnes, soit 8,4 millions de pièces d'une valeur de 8,8 milliards de francs CFP.

Tableau A5-2 : Production aquacole de la Polynésie française en 2014

Produit	Volume		Valeur à la production
	Tonnes	Pièces	
Perles		8 348 000	8 622 000 000
Crevettes	89		160 000 000
Bénitiers		13 500	3 250 000
Platax orbicularis	12		24 000 000
Total	**10**	**8 361 500**	**8 809 250 000**

Synthèse des captures

Le tableau A5-3 présente une première approximation du volume et de la valeur de la production de la pêche et de l'aquaculture en Polynésie française pour l'année 2014.

Tableau A5-3 : Production annuelle de la pêche et de l'aquaculture en 2014

Type de pêche	Volume (tonnes)	Valeur (XPF)
Côtière professionnelle	5 666	3 052 588 235
Côtière vivrière	2 350	1 125 171 000
Hauturière locale	5 390	2 829 000 000
Hauturière étrangère	0	0
Eau douce	100	47 879 616
Aquaculture	8 361 500 pièces et 101 tonnes	8 809 250 000
Total	**8 361 500 pièces et 13 607 tonnes**	**15 863 888 851**

Les figures A5-1 et A5-2 illustrent le volume et la valeur de la production halieutique en Polynésie française en 2014. L'aquaculture n'est pas représentée dans la figure consacrée au volume de production en raison de l'utilisation d'unités de mesure disparates (pièces et tonnes).

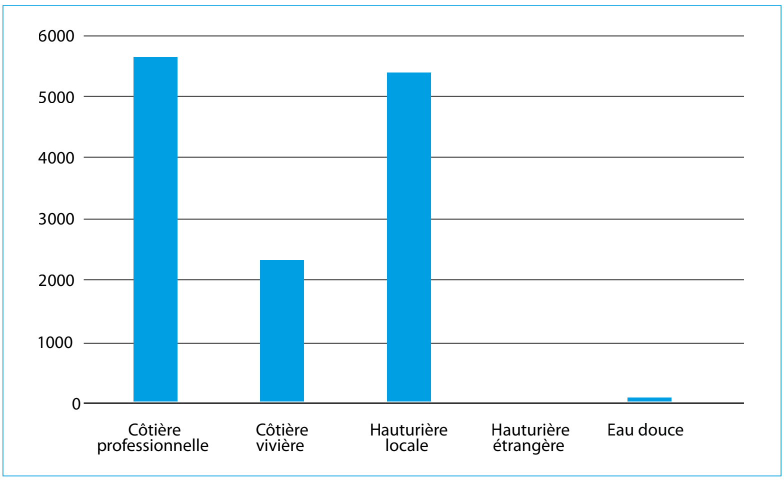


Figure A5-1 : Volume de la production halieutique de Polynésie française en 2014 (exprimé en tonnes)

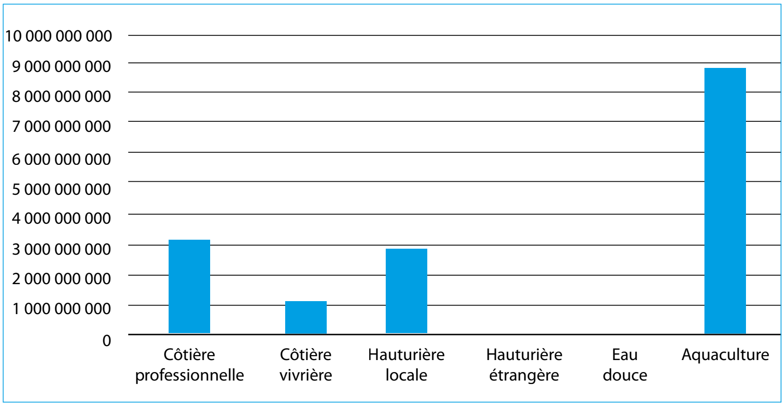


Figure A5-2 : Valeur de la production halieutique de Polynésie française en 2014 (exprimée en francs CFP)

Niveaux historiques de la production halieutique : estimations des 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 (2009) à 2007, tandis que la présente étude porte sur l'année 2014. Les niveaux de la production halieutique de Polynésie française estimés à partir de ces trois études sont reproduits au tableau A5-4[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 A5-4 : Estimations de la production annuelle de la pêche et de l'aquaculture issues des études Benefish

Type de pêche	Année	Volume (tonnes et pièces, le cas échéant)	Valeur nominale (CFP)
Côtière professionnelle	1999	s/o	s/o
	2007	4 002	2 001 400 000
	2014	5 666	3 052 588 235
Côtière vivrière	1999	s/o	s/o
	2007	2 880	1 149 120 000
	2014	2 350	1 125 171 000
Hauturière locale	1999	s/o	s/o
	2007	6 308	2 457 515 000
	2014	5 390	2 829 000 000
Hauturière étrangère	1999	s/o	s/o
	2007	0	0
	2014	0	0
Eau douce	1999	s/o	s/o
	2007	100	42 500 000
	2014	100	47 879 616
Aquaculture	1999	s/o	s/o
	2007	56	10 762 600 000
	2014	8 361 500 pièces et 101 tonnes	8 809 250 000

Source : présente étude, Gillett (2009), Gillett et Lightfoot (2001)

Les variations de la production que l'on constate entre ces trois années de référence correspondent pour partie à une véritable évolution de la production, mais peuvent également s'expliquer par l'adoption d'une méthode nouvelle (que l'on peut espérer meilleure) de mesure de cette même production. Si l'on en croit les chiffres figurant dans le tableau ci-dessus, les niveaux de production annuels des pêches 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'Institut de la statistique de la Polynésie française (ISPF), le dernier calcul détaillé du PIB du Territoire concerne l'année 2011. Au cours des années suivantes, le PIB a fait l'objet d'une évaluation sommaire, ne prenant en compte aucune donnée nouvelle relative au secteur de la pêche (A. Ailloud, communication personnelle, septembre 2014). D'après l'ISPF (2015), en 2014 le PIB de la Polynésie française s'élevait à 538,6 milliards de francs CFP, selon la méthode des comptes rapides.

Sur la base des données de l'ISPF (2015), et de données non publiées du même institut, il est possible de calculer la part du PIB revenant à la pêche, à la perliculture ainsi qu'à d'autres types d'activités aquacoles (tableau A5-5).

Tableau A5-5 : Contribution de la pêche et de l'aquaculture au PIB (prix courants, millions de francs CFP)

	2008	2009	2010	2011
Perliculture	3 258	3 653	3 060	2 965
Pêche et autres types d'aquaculture	3 721	4 070	4 534	5 173
Total pêche et aquaculture	6 979	7 723	7 594	8 138
PIB de la Polynésie française	579 049	563 347	547 877	531 861
Aquaculture et pêche en % du PIB	1.2%	1.4%	1.4%	1.5%

Source : ISPF (2015) et ISPF (données non publiées)

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, septembre 2014) :

- 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 la crevetticulture. S'agissant de la perliculture, la valeur à l'exportation FAB des perles et des

autres produits de la perliculture est multipliée par un coefficient de 0,336 pour obtenir la valeur ajoutée (à savoir la contribution de la perliculture au PIB).

- Le volume de production de la pêche non professionnelle (5 740 tonnes en 2011) a été déterminé sur la base d'une enquête réalisée en 1987. La production de la pêche professionnelle (1 455,613 tonnes en 2011) est obtenue en additionnant les estimations de la production de la pêche professionnelle lagonaire et hauturière, et de la crevetticulture.
- Le prix payé au pêcheur est le prix de vente au détail divisé par 1,35 (dénominateur adopté par l'ISPF).
- Le prix total payé au pêcheur est multiplié par un coefficient pour obtenir la valeur ajoutée totale.
- Le coefficient de valeur ajoutée appliqué à l'ensemble du secteur de l'agriculture professionnelle (comprenant la pêche et la perliculture) est de 0,3361 : il a été fixé après l'étude des comptes de 154 entreprises du secteur agricole pour l'exercice 2005. La valeur ajoutée de la pêche vivrière est fixée à 1 (on part de l'hypothèse qu'il n'y a pas de consommation intermédiaire).

La méthode employée par l'ISPF pour calculer la contribution de la pêche et de l'aquaculture au PIB appelle les observations suivantes :

- S'agissant de la perliculture, l'emploi du prix FAB (et non du prix à la production) entraîne une surestimation de la part de ce secteur dans le PIB, mais permet peut-être de compenser en partie les exportations de perles non déclarées.
- L'estimation de la production de la pêche professionnelle produite par l'ISPF semble très faible par rapport à la production non commerciale : 1 455,613 tonnes contre 5 740 tonnes. D'après les agents de la DRMM, les niveaux de production de ces deux activités se sont considérablement rapprochés au cours des 25 dernières années, si bien que la production lagonaire professionnelle est désormais quasiment égale à celle de la pêche non professionnelle. Pour obtenir la production totale de la pêche professionnelle, il convient d'ajouter les captures de la pêche hauturière (*poti marara*, bonitiers et palangriers) à celles de la pêche lagonaire professionnelle. D'après les informations figurant dans DRMM (2015), le volume de la production de l'ensemble des pêcheries professionnelles est cinq fois supérieur environ à celui de la production non professionnelle.

- Il semble peu judicieux de recourir à un seul et même coefficient de valeur ajoutée pour toutes les activités des professionnels de la pêche, de l'aquaculture et de l'agriculture. En établissant des coefficients de valeur ajoutée pour des sous-secteurs spécifiques, on pourrait sans doute obtenir des estimations plus pertinentes de la valeur ajoutée.

Autre formule de calcul de la contribution de la pêche au PIB

Le tableau A5-6 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 la production a été établie à la section A5.2 (et récapitulée au tableau A5-3), 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 (annexe 3). Le coefficient de valeur ajoutée du secteur de la perliculture a été déterminé en étudiant les livres de compte d'exploitations perlicoles aux Îles Cook et aux Fidji.

Le tableau A5-6 ci-dessous porte sur l'année 2014, tandis que la dernière estimation de la contribution de la pêche au PIB du Territoire concerne l'année 2011.

Il ne s'agit pas de substituer la méthode illustrée au tableau A5-5 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 A5-6 : Contribution de la pêche au PIB en 2014 au moyen d'une autre méthode

Type de pêche	Valeur brute de la production (en CFP, reprise du tableau A5-3)	Coefficient de valeur ajoutée	Valeur ajoutée (CFP)
Côtière professionnelle	3 052 588 235	0.55	1 678 923 529
Côtière vivrière	1 125 171 000	0.70	787 619 700
Hauturière locale	2 829 000 000	0.20	565 800 000
Eau douce	47 879 616	0.85	40 697 674
Aquaculture	8 809 250 000	0.45	3 964 162 500
Total (CFP)			**7 037 203 403**

Ce tableau fait apparaître une contribution globale de la pêche et de l'aquaculture d'une valeur de 7,037 milliards de francs CFP en 2014. Dans la section ci-dessus, la contribution officielle est estimée à 8,138 milliards de francs CFP en 2011. Sachant que ces deux estimations ne se rapportent pas à la même année, l'écart constaté est dû en grande partie à la production de la pêche côtière/hauturière, ainsi qu'au coefficient de valeur ajoutée appliqué. La DRMM de Papeete dispose d'estimations de la production halieutique de qualité raisonnable.

Si la dernière estimation détaillée du PIB porte sur l'année 2011, des «comptes rapides» ont été réalisés pour l'année 2014. Ils ont permis d'évaluer le PIB du Territoire à 538,6 milliards de francs CFP (CEROM 2015)[3]. L'estimation de la contribution de la pêche au PIB en 2014 présentée dans le tableau ci-dessus (7,037 milliards de francs CFP) correspond à 1,3 % du PIB de 2014.

A5.3 Exportations

L'ISPF (ISPF 2015) publie le volume des exportations de la Polynésie française (calculées probablement à partir des données douanières, ceci restant toutefois à confirmer). Le tableau A5-7 reprend les données qui concernent la pêche.

Tableau A5-7 : Exportations de la pêche et de l'aquaculture (en millions de francs CFP)

	2013	2014
Produits perliers	7 881	8,819
Poisson	1 093	1 241
Nacre	249	199
Total des exportations de la pêche et de l'aquaculture	9 223	10 259
Total des exportations de la Polynésie française	11910	12 824
Exportations de la pêche et de l'aquaculture en % des exportations totales	77.4%	80.0%

Source: ISPF (2015)

Les données plus détaillées relatives aux exportations figurant dans DRMM (2015) sont reprises au tableau A5-8 qui présente les exportations par ordre croissant de leur valeur.

3 Ces «comptes rapides» ne comportent pas de données détaillées relatives à la pêche.

Tableau A5-8 : Part relative de la pêche et de l'aquaculture dans les exportations en 2014

	Volume		Valeur FAB (en millions de francs CFP)	% de la valeur FAB de la totalité des exportations de la pêche et de l'aquaculture
	Pièces	Tonnes		
Poissons d'aquariophilie	27 900		23,8	0,2%
Bêche de mer		3,9	25,9	0,3%
Bénitiers	33 890		46,8	0,5%
Coraux et coquillages (nacre, troca, burgau)		2 232	283	2,8%
Poissons pélagiques		1 445	1,140	11,2%
Perles et produits perliers	8 355		8,704	85,1%
Total	**70 145**	**3 681**	**10 223.5**	**100,0%**

Source : adaptation de données de la DRMM (2015)

A5.4 Recettes publiques tirées de la pêche

Droits d'accès acquittés par les flottilles de pêche étrangères

En décembre 2000, tous les accords d'accès contractés avec des flottilles de pêche étrangères étaient éteints (Ponsonnet *et al.* 2007). De ce fait, aucune redevance n'est plus perçue à ce titre.

Autres recettes publiques issues de la pêche

On entend par pêcheurs professionnels les pêcheurs détenteurs d'une licence de pêche et à qui est délivrée une carte professionnelle. La licence est obligatoire pour la pratique de la pêche hauturière, mais facultative pour la pêche côtière. Les pêcheurs détenteurs d'une licence peuvent prétendre à des aides financières substantielles. La licence de pêche est délivrée gratuitement.

Les exportations de perles sont assujetties à une taxe modique. En 2009, elle est passée de 200 francs CFP par gramme à 50 francs CFP par perle. En 2010, cette taxe a rapporté 493 millions de francs CFP (DRMM 2014). À l'origine destinée au financement de la promotion du secteur de la perle, cette taxe alimente désormais le budget général du Territoire (C. Lo, communication personnelle, septembre 2015).

De manière générale, le secteur de la pêche de Polynésie française n'est pas producteur de recettes, mais plutôt consommateur de subventions publiques. De nombreuses aides financières sont prévues pour les différents sous-secteurs de la pêche. La DRMM (non daté) recense plusieurs types de subventions auxquelles peuvent prétendre les professionnels de chacune des trois catégories de pêche : lagonaire, côtière et hauturière.

A5.5 Emploi

Le Bulletin statistique de la DRMM (DRMM 2015) offre un inventaire très complet de la production halieutique et aquacole en Polynésie française. Il est en revanche plus difficile de trouver des données relatives à la dimension socioéconomique de la pêche sur le Territoire. L'enquête sur le budget des familles réalisée en 2014 renfermera sans doute des données sur l'emploi dans le secteur de la pêche, mais elle ne sera publiée qu'à la mi-2016.

On dispose de certaines données récentes sur l'emploi dans le secteur de la perle (probablement en raison de l'obligation pour les travailleurs du secteur de détenir une carte professionnelle). Une étude sur l'emploi en Polynésie française réalisée par l'ISPF (ISPF 2015) montre que les effectifs du secteur perlicole atteignaient 1 060 emplois en 2014. Une autre étude de l'ISPF consacrée à la filière (ISPF 2014) indique qu'à la fin décembre 2013, on comptait 815 salariés déclarés dans les fermes perlicoles. Toutefois, la majorité d'entre elles étant des exploitations familiales, le nombre d'employés non déclarés y est sans doute assez élevé. D'après l'étude, la filière emploie également 85 personnes dans le domaine de la joaillerie, 116 dans la commercialisation/vente au détail, ainsi que 230 greffeurs.

Pour mieux appréhender l'importance relative de ces chiffres, il faut savoir qu'en 2014, on dénombrait 69 800 salariés sur l'ensemble du Territoire (ISPF 2015), dont la population s'élevait à 262 059 habitants (site PRISM de la CPS).

On dispose par ailleurs de données plus anciennes sur l'emploi dans le secteur de la pêche. Le tableau A5-9 a été établi à partir de données non publiées du Service de la pêche (organisme auquel a succédé la DRMM) et indique le nombre des actifs dans les domaines de la pêche et de l'aquaculture (hors perliculture). En 2007, on comptait 13 emplois dans le domaine de l'aquaculture hors perliculture, 1 800 dans la pêche côtière, 1 025 dans la pêche hauturière et 200 dans la pêche d'eau douce.

Tableau A5-9 : Nombre d'emplois dans le secteur de la pêche en Polynésie française

	Homme (H)/ Femme (F)	2006	2007
Plein temps	H	2049	2127
	F	144	86
Temps partiel	H	1589	1658
	F	391	408
Occasionnel	H	4270	4270
	F	1830	1830
Statut non précisé	H	200	200
	F		
Total	H	8108	8255
	F	2365	2324

Source : Données non publiées, Service de la pêche ; unités : nombre de personnes

S'agissant de la pêche à petite échelle, le programme ProcFish de la CPS a permis la réalisation d'enquêtes sur cinq sites en Polynésie française (Kronen *et al.* 2008). Le tableau A5-10 est extrait du rapport correspondant et montre l'importance de la pêche récifale et de la vente de poissons.

Tableau A5-10 : Participation à la pêche sur les sites ProcFish

Site	Foyers participant à la pêche récifale	Foyers dont la pêche est la principale source de revenu
Fakarava	88.0%	12.0%
Maatea	78.6%	17.9%
Mataiea	77.4%	3.2%
Raivavae	93.3%	6.7%
Tikehau	91.7%	37.5%
Moyenne des 5 sites	**85.5%**	**14.5%**

Source: Kronen *et al.* (2008)

La CPS (2013) s'appuie sur les données issues du programme ProcFish 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

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. Cette étude a été menée 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.* (2009) 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 de la structure de consommation du poisson dans les pays océaniens. Ces enquêtes avaient été conçues pour déterminer quelle part de la consommation était attribuable 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'élève à 70,3 kg, dont 82 % de poisson frais. La consommation annuelle par habitant est estimée à 90,1 kg dans les zones rurales, contre 52,2 kg en zone urbaine.

Même si l'on part du constat que les deux études susmentionnées mesurent différents types de consommation (poids réel des aliments et poids entier équivalent), les résultats restent fortement contrastés. Si l'on ajuste les résultats du Service de la pêche en rétablissant le poids entier équivalent, on obtient une consommation annuelle par habitant de 46,5 kg, contre 70,3 kg dans l'étude de Bell *et al.*

Le Centre de recherche halieutique (*Fisheries Centre*) de l'Université de Colombie britannique a passé en revue (Bale *et al.* 2009) les différentes études relatives à l'estimation de la consommation de poisson en Polynésie française et a 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).

Dans le cadre du projet ProcFish de la CPS, des enquêtes ont été réalisées sur cinq îles (Kronen *et al.* 2008). Ce travail inclut des estimations de la consommation de poisson par habitant (tableau A5-11) et fait état d'une très forte consommation de poisson frais.

Tableau A5-11 : Consommation de produits de la pêche sur les sites ProcFish (kg/personne/année)

Site	Consommation de poisson frais	Consommation d'invertébrés	Consommation de poisson en conserve
Fakarava	63,94	2,13	4,13
Maatea	59,91	0,26	5,09
Mataiea	45,13	0,96	2,37
Raivavae	46,42	18,03	3,95
Tikehau	66,59	1,90	4,08
Moyenne des 5 sites	**55,55**	**4,91**	**3,95**

Source: Kronen *et al.* (2008)

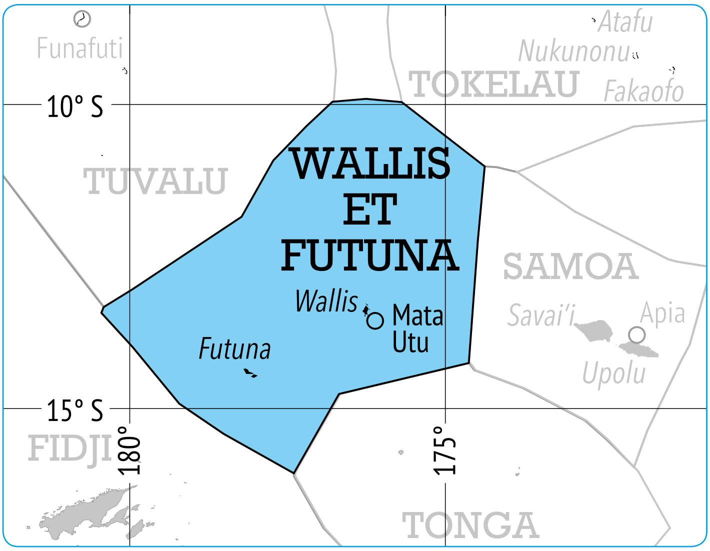
La consommation locale de poisson est alimentée par une filière relativement nouvelle. Ce n'est en effet qu'au début des années 90 que la pêche à la palangre a commencé à être pratiquée à Tahiti à une échelle significative. En 2014, la flottille a capturé 5 390 tonnes de thon et autres poissons pélagiques, dont 1 140 tonnes ont été exportées (DRMM 2015). Les 4 250 tonnes restantes représentent 23,6 kg pour chacun des 180 000 résidents de Tahiti.

A5.7 Taux de change

Les taux de change annuels moyens (dollar É.-U. en francs CFP) utilisés dans le présent rapport sont les suivants :

2000	2001	2002	2003	2004	2005	2006	2007
130	133	127	106	96	96	95	87
2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	
80.0	83.22	90.27	92.16	89.88	86.01	98.13	

Appendix 6: Wallis et Futuna



A6.1 Volume et valeur des captures de poisson à Wallis et Futuna

Captures des pêcheurs professionnels côtiers à Wallis et Futuna

Par le passé, plusieurs tentatives ont été menées pour prendre la mesure de la pêche côtière à Wallis et Futuna. On peut notamment citer les travaux suivants :

- 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 (2009) 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), l'enquête budget des familles réalisée entre juin 2005 et mai 2006 auprès de 1 025 ménages (Buffière 2006), ainsi que les 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 (franc Pacifique).

Si l'enquête agricole réalisée en 2014 à Wallis et Futuna (Sourd et Mailagi 2015) est consacrée en premier lieu à ce secteur d'activité, elle comporte également un certain nombre d'informations relatives à la pêche. Parmi les éléments ayant une incidence sur le total annuel des captures, on peut citer les suivants :

- En comparant les résultats obtenus avec ceux d'une enquête précédente, 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.
- Sur les 658 ménages interrogés qui pratiquent la pêche, 179 utilisent leur propre bateau, 99 un bateau dont ils ne sont pas propriétaires et 380 pêchent sans bateau.
- Ces 658 ménages ciblent en premier lieu les poissons du lagon (361 ménages), les poissons pélagiques (241), les crustacés (30) et d'autres coquillages (26).
- Le prix de vente moyen pratiqué est situé entre 900 et 1 000 francs CPF le kilo pour 59 % des ménages, alors que 32 % d'entre eux pratiquent un prix inférieur et 9 % un prix supérieur.
- On trouvera au tableau A6-1 des données relatives à la destination des captures.

Tableau A6-1 : Destination des captures par type de pêche

Type de pêche	Nombre de foyers concernés	Coutume		Autoconsommation		Vente	
		Oui	Non	Oui	Non	Oui	Non
Pêche à la traîne	140	67	73	137	3	68	72
Pêche au vivaneau	49	29	20	47	2	32	17
Pêche à la palangrotte	169	81	88	169	-	57	112
Pêche au filet	327	119	208	321	6	76	251
Chasse sous-marine	287	112	175	281	6	114	173
Ramassage de coquillages	129	43	86	128	1	36	93
Ramassage de crustacés	104	39	65	102	2	43	61
Autres types de pêche	74	21	53	72	2	8	66

Source : Sourd et Mailagi (2015)

Un agent du Bureau de la pêche et de l'aquaculture (Communication personnelle de B. Mugneret, novembre 2015) fournit les précisions suivantes :

- Si le passage du cyclone Evan à la fin 2012 a causé des dégâts considérables dans les cultures, peu de bateaux ont été endommagés. De ce fait, on a assisté à une hausse de la production halieutique afin de maintenir les disponibilités alimentaires.
- Le nombre de dispositifs de concentration de poissons opérationnels est resté relativement stable au cours des dix dernières années (environ 3 ou 4 DCP sur le Territoire).
- En 2013, on a enregistré un sursaut de la pêche commerciale, en amont des Mini-Jeux du Pacifique ainsi que pendant la manifestation.
- En 2014, les exportations de trocas et de bêches-de-mer ont été inexistantes, les colliers en coquillages constituant le seul produit halieutique exporté en quantités non négligeables.

Les éléments suivants peuvent présenter une certaine pertinence dans le cadre de l'estimation de la production de la pêche côtière :

- La population de Wallis et Futuna a décliné de 14,9 % entre 2007 et 2014 (années de référence de l'enquête de Gillet (2009) et de la présente étude respectivement). (Données fournies par le site PRISM de la CPS).
- Kronen *et al.* (2008) citent plusieurs auteurs ayant évoqué la surpêche dans le lagon de Wallis, dès le début des années 30. Par le passé, la surpêche a essentiellement été associée à l'emploi de méthodes de pêche

destructrices (explosifs et divers poisons notamment) et au recours à des filets maillants à petit maillage.ur la base des données d'une enquête sur le budget des ménages, Bell *et al.* (2008) estiment que 86 % de la production halieutique côtière à Wallis et Futuna est destinée à l'autoconsommation et 14 % à la vente. Les auteurs s'appuient également sur la superficie du récif pour estimer la production annuelle à 150 tonnes.

Les éléments qui précèdent laissent penser que, depuis l'estimation de Gillett (2009), la production halieutique totale a légèrement baissé (comme en témoignent la réduction du nombre de bateaux, le déclin démographique et un certain niveau de surpêche), et que la commercialisation a légèrement augmenté sous l'effet de l'évolution du paysage économique. Pour 2014, la production de la pêche côtière professionnelle est estimée à 150 tonnes, soit 150 millions de francs CFP.

Captures de la pêche côtière vivrière

En suivant le même raisonnement, on peut estimer à 675 tonnes les captures de la pêche côtière vivrière pour 2014. Sur la base du prix à la production, la valeur de ces captures est évaluée à 641 250 000 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 de flottille locale de pêche hauturière à Wallis et Futuna.

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).

Captures en eau douce

La pêche en eau douce n'est pas pratiquée 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.

Production aquacole

Si des expérimentations ont été réalisées il y a peu dans le domaine de l'aquaculture à Wallis (*Macrobrachium* par exemple, Nandlal 2005), il n'existe pas actuellement de production aquacole sur le Territoire.

Synthèse des captures

Le tableau A6-2 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 2014.

Tableau A6-2 : Production annuelle de la pêche et de l'aquaculture à Wallis et Futuna en 2014

Type de pêche	Volume (en tonnes)	Valeur (CFP)
Côtière professionnelle	150	150 000 000
Côtière vivrière	675	641 250 000
Hauturière locale	0	0
Hauturière étrangère	0	0
Eau douce	0	0
Aquaculture	0	0
Total	**825**	**791 250 000**

Les figures A6-1 et A6-2 illustrent le volume et la valeur de la production halieutique à Wallis et Futuna en 2014. L'aquaculture n'est pas représentée dans la figure consacrée au volume de production en raison de l'utilisation d'unités de mesure disparates (pièces et tonnes).

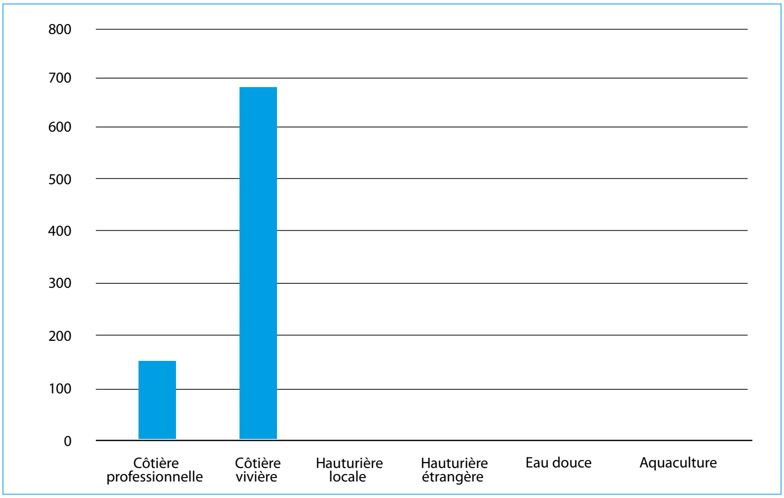


Figure A6-1 : Volume de la production halieutique de Wallis et Futuna en 2014 (exprimée en tonnes)

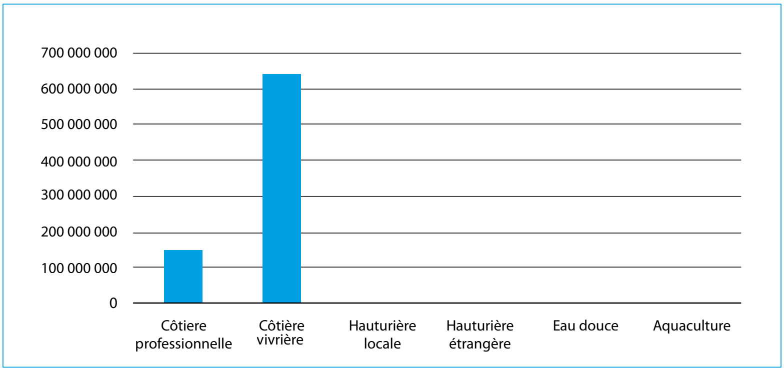


Figure A6-2 : Valeur de la production halieutique de Wallis et Futuna en 2014 (exprimée en francs CFP)

Niveaux historiques de la production halieutique : estimations des 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 (2009) à 2007, tandis que la présente étude porte sur l'année 2014. Les niveaux de la production halieutique de Wallis et Futuna mis en évidence par ces trois études sont reproduits au tableau A6-3[1].

1 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 A6-3 : Estimations de la production annuelle de la pêche et de l'aquaculture issues des études Benefish

Type de pêche	Année	Volume (tonnes et pièces)	Valeur nominale (CFP)
Côtière professionnelle	1999	s/o	s/o
	2007	121	105 000 000
	2014	150	150 000 000
Côtière vivrière	1999	s/o	s/o
	2007	840	551 000 000
	2014	675	641 250 000
Hauturière locale	1999	s/o	s/o
	2007	0	0
	2014	0	0
Hauturière étrangère	1999	s/o	s/o
	2007	0	0
	2014	0	0
Eau douce	1999	s/o	s/o
	2007	0	0
	2014	0	0
Aquaculture	1999	s/o	s/o
	2007	0	0
	2014	0	0

Source : présente étude, Gillett (2009), Gillett et Lightfoot (2001)

A6.2 Contribution de la pêche au PIB (produit intérieur brut)

Contribution officielle actuelle

La dernière estimation du PIB de Wallis et Futuna date de 2005. Le rapport de l'Institut d'émission d'Outre-mer (IEOM) (2015) note qu'il n'existe pas, sur le Territoire, de structure chargée du calcul du PIB annuel. Toutefois, dans le cadre des travaux CEROM (Comptes économiques rapides pour l'Outre-Mer) réalisés en 2008, une évaluation du PIB de Wallis et Futuna a été établie à 18 milliards de francs CFP pour l'année 2005. Ceci correspond à un PIB par habitant d'environ 1,2 million de francs CFP.

Méthode de calcul de la contribution officielle de la pêche au PIB

On ne dispose d'aucune information sur la méthode qui a été employée pour calculer la contribution de la pêche au PIB. Les documents existants sont muets à ce sujet et les agents actuellement en poste dans les bureaux de l'IEOM à Wallis et au Service territorial de la statistique ignorent comment les estimations ont été réalisées.

Estimation de la contribution de la pêche au PIB

Le tableau A6-4 ci-dessous présente une méthode d'estimation de la contribution de la pêche au PIB à 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 A6-2), et à déterminer la valeur ajoutée à l'aide de coefficients de valeur ajoutée 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 A6-4 : Contribution de la pêche au PIB de Wallis et Futuna en 2014

Type de pêche	**Valeur brute de la production** (en CFP, reprise du tableau A6-3)	Coefficient de valeur ajoutée	**Valeur ajoutée** (CFP)
Côtière professionnelle	150 000 000	0,65	97 500 000
Côtière vivrière	641 250 000	0,80	513 000 000
Hauturière locale	0	0	0
Eau douce	0	0	0
Aquaculture	0	0	0
Total (CFP)			**610 500 000**

Il n'est pas possible de déterminer à quelle proportion du PIB de Wallis et Futuna cette somme de 610,5 millions de francs CFP correspond : en effet, le tableau ci-dessus se rapporte à l'année 2014, alors que le dernier calcul du PIB concerne l'année 2005. Dans son étude, Gillett (2009) 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

Le troca, la bêche-de-mer et l'artisanat constituent les principaux produits d'exportation de Wallis et Futuna recensés au cours des dernières années. On dispose à ce sujet des données suivantes :

- En 2014, on n'a enregistré aucune exportation de trocas ou de bêches-de-mer, alors qu'en 2013, ce sont quelque 2,7 tonnes de bêches-de-mer qui avaient été exportées (B. Mugneret, communication personnelle, novembre 2015).
- En 2014, les colliers en coquillages achetés par les voyageurs quittant le Territoire semblent avoir constitué le seul produit d'exportation notable, pour une valeur franco à bord estimée à 10 millions de francs CFP sur l'année.
- Le rapport de l'IEOM (2015) indique que la valeur totale des exportations de Wallis et Futuna s'est élevée en 2014 à 21,5 millions de francs CPF, les produits de la mer et artisanaux étant les seuls produits exportés.
- Les dernières statistiques détaillées relatives aux exportations dont dispose le Service territorial de la statistique datent de 2011, année au cours de laquelle 1,078 tonne de bêches-de-mer (valeur déclarée de 348 050 CFP) et 17 tonnes de trocas (valeur déclarée de 5 100 000 CFP) avaient été exportées.

A6.4 Recettes publiques tirées de la pêche

Droits d'accès acquittés par les flottilles de pêche étrangères

Depuis 1999, on ne compte aucun accord d'accès accordé à des flottilles de pêche étrangères (Service de la pêche et de l'aquaculture, 2007). De ce fait, aucune redevance n'a été perçue à ce titre.

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. Ces dernières peuvent être obtenues pour l'achat d'un bateau de pêche (jusqu'à 60 % des frais de construction selon nos informations) et du carburant nécessaire à son fonctionnement (jusqu'à 60 %). Les équipements de sécurité en mer sont détaxés (B. Mugneret, communication personnelle, novembre 2015).

A6.5 Emploi

Dans son rapport de 2015, l'IEOM estime que l'on compte environ 40 pêcheurs professionnels (pratiquant la pêche commerciale à plein temps) à Wallis et Futuna, avec quelque 20 unités de pêche, mesurant pour la plupart entre 6 et 10 mètres de long. On estime également qu'un tiers des ménages pratiquent la pêche d'une manière ou d'une autre.

Une étude récente (Sourd et Mailagi 2015) s'est penchée sur la participation à la pêche. Ses résultats sont présentés au tableau A6-5.

Tableau A6-5 : Participation à la pêche à Wallis et Futuna

Zone de résidence	Participation à la pêche ?		Pourcentage de participation
	Oui	Non	
Alo	170	237	41,8 %
Sigave	93	169	35,5 %
Total Futuna	**263**	**406**	**39,3 %**
Hahake	82	429	16,0 %
Hihifo	126	190	39,9 %
Mua	187	369	33,6 %
Total Wallis	**395**	**988**	**28,6 %**
Total Wallis et Futuna	**658**	**1 394**	**32,1 %**

Source : Sourd et Mailagi (2015)

L'étude la CPS (1999) examine les rôles revenant respectivement aux femmes et aux hommes dans le secteur de la pêche à Wallis et à Futuna. À Futuna, ce sont les hommes qui pêchent, mais les femmes fournissent l'essentiel des produits de la mer destinés à la consommation quotidienne. Le relief de Futuna est plus escarpé que celui de l'île de Wallis, et il faut souvent s'éloigner des villages pour trouver des surfaces cultivables, par ailleurs situées dans des terrains difficiles. Le travail de la terre est donc moins éprouvant à Wallis, où il est le plus souvent confié aux femmes. Ceci explique pourquoi les Wallisiennes sont moins impliquées dans les activités halieutiques que les habitantes de Futuna.

Le rapport de la CPS (2013) indique que sur l'ensemble du Territoire de Wallis et Futuna, un peu plus de la moitié des pêcheurs sont des hommes.

A6.6 Niveaux de consommation de la ressource halieutique

Sur la base de la production halieutique de Wallis et Futuna ainsi que des importations et 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.* (2009) 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 de la structure de consommation du poisson dans les pays océaniens. Ces enquêtes avaient été conçues pour déterminer quelle part de la consommation était attribuable 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.

Les auteurs de la présente étude estiment la production de la pêche côtière (vivrière et professionnelle) pour l'année 2014 à 825 tonnes. Ceci correspond à 68,7 kg pour chacun des 12 011 habitants de Wallis et Futuna (données issues du site PRISM de la CPS). Ce chiffre ne tient pas compte des importations de produits halieutiques.

A6.7 Taux de change

Les taux de change annuels moyens (dollar É.-U. en francs CFP) utilisés dans le présent rapport sont les suivants :

2000	2001	2002	2003	2004	2005	2006	2007
130	133	127	106	96	96	95	87
2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	
80,0	83,22	90,27	92,16	89,88	86,01	98,13	

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Fisheries in the Economies of Pacific Island Countries and Territories

The benefits of fisheries to the people and economies of the Pacific region extend far beyond their economic returns, and managing these fisheries sustainably is important at every level. Maintaining up-to-date information about the various components of the fisheries sector is critical in enabling Pacific Island countries and territories (PICTs), and their communities, to make informed decisions about management of local and regional fisheries, and for a range of development organisations, institutions and donors to plan and implement effective development assistance in collaboration with PICTs.

Accessible and current fisheries data remains elusive in the Pacific region, especially in coastal fisheries, seven years on from the first edition of this work in 2009, and 15 years after the issue was raised in the 2001 Benefish study. A regional commitment to improving the collection of uniform fisheries statistics must evolve if real progress is to be made in managing fisheries in the region in a coordinated and sustainable way.

Through the extensive field research carried out in this study, this volume provides updated, original information in a range of fisheries areas that will be extremely useful for Pacific Island countries and territories and their communities, and for regional organisations, research institutions, non-governmental organisations and donors.

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 26 members, including 22 Pacific Island countries and territories. For almost 70 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 Fiji and Federated States of Micronesia, 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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