Mapping coastal fisheries data collection of Pacific Island countries and territories

FINAL REPORT

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Table of Contents

Glossary

Baited Remote Underwater Video (BRUV) surveys – the use of baited bags secured on the ocean floor and attached to a video camera to remotely record species presence/absence data, and sometimes size measurements.

Biological surveys – sampling of fisheries catches (fisheries-dependent or -independent) to obtain biological materials used for analysis of the fish's biology (e.g., fin clips for genetics, otoliths for ageing, gonad examination and/or collection for reproductive analyses, etc.).

Creel surveys – sampling surveys that traditionally targets recreational fishers at landing sites to collect data about their catches and can include catch, effort, social and economic information. In the Pacific creel surveys refers to landing site surveys of all fisher types.

C-MSY – a data-limited catch-based stock assessment method that requires a time series of catch data from the fishery and information on resilience for the species concerned. See Martell and Froese (2013).

ELEFAN – Electronic Length Frequency Analysis (ELEFAN) is a data-limited assessment method used in fisheries to fit a growth curve for a fish stock using only length data.

Fisheries-dependent monitoring – methods for collecting fishery data directly from the fishery, usually by sampling the catches of fishers. Some of the most reliable methods include creel surveys, market surveys and fisher logbooks. Household surveys are also considered fishery-dependent however their accuracy can be questionable given the data are based on respondents' recollection of fishing activities.

Fisheries-independent monitoring - methods for collecting data about the fishery resources independent of the fishery, often through direct observation or experimental fishing, relies on specialists, and is usually subject to a rigorous sampling design. Examples include underwater visual surveys, biological sampling or Baited Remote Underwater Video surveys (BRUVs).

Household surveys – an interview-based survey method conducted in people's homes principally to collect fisheries socio-economic information, but also often used for the collection of fisheries catch and effort data, although the reliability of the latter data is questionable due to it being recalled from memories of interviewees.

IKASAVEA - a mobile app developed by Pacific Community (SPC, Coastal Fisheries Programme) to ease data entry in relation to market surveys conducted by fisheries surveyors in Pacific Community member countries.

Length Based Spawning Potential Ratio (LB-SPR) – a data-limited fisheries assesssment method that estimates whether a fished stock is being overfished or not. It only requires a representative sample of the size structure of the vulnerable portion of the population (i.e., the catch) and an understanding of the life history of the species.

Market surveys – sampling of fisheries catches at the point of sale, including fish markets, roadside stalls, fisher co-operatives and retail outlets.

Percentage of the catch < length at maturity (Lm) – a very simple data-limited assessment method that provides a proxy method as an indicator of whether overfishing is likely to be

occurring or not. It simple requires a representative sample of the size structure of the catch and estimates of the size at maturity for the species.

PICT – Pacific Island Country and Territory.

PROCFish/C - The Pacific Regional Oceanic and Coastal Fisheries Development Programme, led by The Pacific Community (SPC) across 17 PICTs during 2002-2009.

SDG – Sustainable Development Goals.

Snapshot data collection – refers to data collected in a single period of time.

SPC – The Pacific Community; the key representative agency in the Pacific region tasked with supporting the 22 countries and territories, based in Noumea, New Caledonia.

TAILS – a smartphone and tablet app developed by SPC for Pacific coastal fisheries staff to collect data on artisanal tuna catches, with the capacity for limited reef fish catch data collection.

Underwater Visual Surveys (UVS, UVC) – survey methods used by divers in-water to collect data on shallow aquatic habitats including benthic (corals, algae), invertebrates and fish.

YPR – a stock assessment method initially proposed as early as 1957 (Beverton and Holt, 1957) and is used to estimate yield and biomass per recruit over a range of fishing mortality rates (F) and selectivity definitions, and determines the stock status based on current F relative to biological reference points.

1. Project background

The exclusive economic zones of the 22 Pacific Island Countries and Territories (PICTs) covers in excess of 27 million km^2 and cover a significant portion of the tropical and subtropical Pacific Ocean (Figure 1). Reflecting the diversity of the region there are three main subregions based on the physical nature of the islands, their biogeography as well as ethnic and cultural backgrounds: Melanesia, Micronesia and Polynesia. Oceanic environments in the region provide the world's largest catch of tuna species representing significant value to the GDP of PICTs (Bell et al., 2011). As a general rule across the region, this has resulted in a much lower priority in the management of coastal fisheries (e.g., Gillett et al., 2014). Despite this, coastal marine resources provide subsistence food and livelihoods at the local level, and provide 50-90% of animal protein for Pacific Islanders (Bell et al., 2018a, b; Gillett and Tauati, 2018; Johnson et al., 2017).

The Food and Agriculture Organization of the United Nations (FAO) collects statistical data from its member countries, including 14 from the Pacific, on a number of important indicators on fisheries and aquaculture. FAO global data and information on fisheries now also feed into reporting on the Sustainable Development Goals (SDG's), including SDG 14 and the four indicators for which FAO is custodian: SDG 14.4.1, SDG 14.6.1, SDG 14.7.1 and SDG 14.b.1. Many Pacific Island nations find it difficult to accurately respond to the requests for statistics issued by FAO and data collection programs, especially for coastal stocks.

FAO Pacific currently has a project entitled "*Strengthening capacity to monitor SDG 14 (targets 14.4, 14.6, 14.7 and 14.b) in the Pacific region*" which focuses on improved reporting and understanding of tools and methodologies on the four fisheries-related SDG 14 indicators. This project was rolled out during 2021 through a series of workshops and trainings on each of the four indicators. This report summarises a data mapping exercise (consultancy) conducted to support these trainings, by establishing a better understanding of the data collection methodologies currently in place for coastal fisheries and to identify gaps and needs of Pacific countries, particularly as they relate to reporting for SDG Indicator 14.4.1: "*Proportion of fish stocks within biologically sustainable levels"*.

SDG Indicator 14.4.1 requires a minimum level of data in order to assess and monitor the status of fish stocks. In data-limited situations, basic data for monitoring stock status include either catch time series and fishing effort information or length-frequency distribution data. Some information on biological parameters for the stock (e.g., max length, age, and growth parameters) are also necessary. A goal of this consultancy is to determine if the countries have sufficient data to implement stock monitoring or assessment methodologies advocated for SDG14.4.1 reporting, including data-limited methods such as catch-based CMSY, or length-based per-recruit workflows such as Elefan and YPR. The mapping exercise focuses on coastal species and excludes species whose distributions are straddling between national jurisdictions and the high seas, are purely high seas, or are highly migratory, such as tuna and tuna-like species; these species are covered by the regional and global indicator.

Pacific Island Countries and Territories (PICT)-specific information is key to identifying specific needs and providing the necessary support to improve regional data collection overall. Therefore, the project aims were to: 1) determine how current data collections can be used or improved to accommodate the needs of stock assessment and reporting on the Indicator 14.4.1, and 2) what is needed to improve fishery data collections and facilitate statistical reporting.

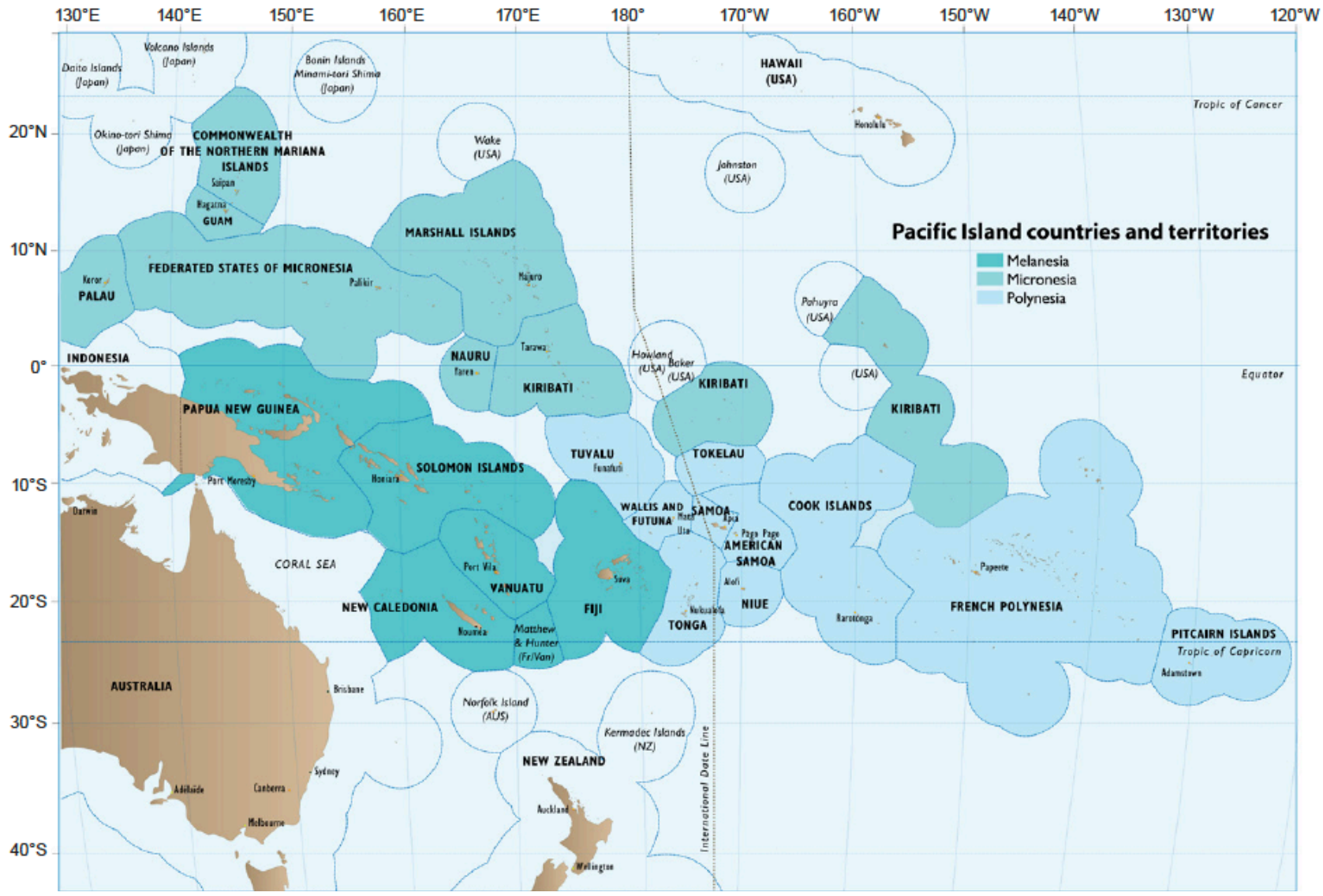

Figure 1. Map of the 22 Pacific Island Countries and Territories showing the cultural subregions and respective Exclusive Economic Zones. Source: Bell et al. (2011).

2. Project approach

One of the key initial tasks of the project was to establish the current available data for coastal species in the Pacific. This was done through three general mechanisms:

i Direct consultation with relevant country/territory representatives;
ii Consultation with key local and regional partner organisations; and
iii Online searches.

To facilitate overall capacity building across the whole region, all 22 PICTs were consulted during this project. The key mechanism for information gathering from each PICT was a standardised questionnaire that was sent to established contacts in each PICT, including the use of the SPC (the Pacific Community) fisheries address book, which contains contacts for key fisheries agencies in the region (https://coastfish.spc.int/en/publications/fisheries-address-book). Many regional partner organisations are known to have been involved in coastal fisheries-related data collection activities across the Pacific for several decades. Therefore, many of these organisations were also consulted to better understand available data sets and collection activities. These organisations included: The Pacific Community (SPC), The Nature Conservancy (TNC), World Wide Fund for Nature (WWF), Wildlife Conservation Society (WCS), University of Guam, Palau International Coral Reef Center (PICRC), University of the South Pacific (USP), Biospherics P/L, and the National Oceanic and Atmospheric Administration (NOAA). Finally, extensive internet searches were conducted to identify relevant data collections, mainly identified through published reports and journal articles.

It is important to note that the information obtained about past data collections in the Pacific was not exhaustive and was limited due to multiple factors including time available during the consultancy, online accessibility of data sets or information about them, and the rate and extent of responses arising from PICT consultations. Further, although the term 'fish' is applied to be inclusive of finfish and invertebrates in the FAO SDG reporting process and terminology, interpretations during consultations resulted in the data mapping exercise applying only to finfish data collections. Despite this, results of the data mapping exercise are thought to be indicative of all coastal fisheries data collections.

Although any monitoring data has the potential to be useful in informing fisheries resource status and management, fisheries-dependent monitoring is more likely to provide the necessary data since they usually collect data directly from the fishery that are therefore more representative of the fishery characteristics. Therefore, the type of coastal fisheries data collection among PICTs was of key interest.

Information about the available data sets were collated for each PICT to:

i Identify the types and extent of available data collections;
ii Identify how the data have been used for assessment and management;
iii Determine the capacity for current data to apply a range of selected data-limited assessment methods;
iv Assess the key gaps in data collection activities; and
v Make recommendations to facilitate improved data collection activities and reporting of SDG 14.4.1.

3. Overview of PICT data collection projects and activities

As noted above, the following summaries of data collections among PICTs is not exhaustive. Despite this, the data collections summarised here represents in excess of 100 different projects and data collection activities, and therefore the conclusions from the analyses of data collections are likely to be indicative of the situation in the Pacific. In acknowledging that there are likely to be many relevant data collections not identified during this mapping exercise, it is worth noting several key known databases of data collections for the region that have not been exhaustively examined due to limited accessibility of data contained within, the sheer quantity of metadata to process, and project timelines. Such data repositories include the SPC fisheries database (https://www.spc.int/CoastalFisheries/DataRepository/Public/Browse), the Global Coral Reef Monitoring Network (GCRMN; https://gcrmn.net), MERMAID (https://dashboard.datamermaid.org), and NOAA (https://apps-pifsc.fisheries.noaa.gov/library/). For example, MERMAID contains coral reef transect data from different parts of the world that includes benthic, coral bleaching, invertebrate and fish survey data. Accessing relevant details of the data requires administrative approval and registration, and only high-level information can be accessed otherwise. For example, the Fiji Ministry of Fisheries has what appears to be fish transect records for 74 sites that includes 571 transects (https://dashboard.datamermaid.org/?organization=Fiji%20Ministry%20of%20Fisheries).

Table 1. Responses rate for questionnaires sent to all 22 PICTs.

	COUNTRY/ TERRITORY	Surveys completed	Contact acknowledged
POLYNESIA	American Samoa	No	Yes
	Cook Islands	Yes	Yes
	French Polynesia	Yes	Yes
	Niue	No	Yes
	Pitcairn Islands	No	No
	Samoa	Yes	Yes
	Tokelau	Yes	Yes
	Tonga	Yes	Yes
	Tuvalu	Yes	Yes
	Wallis and Futuna	Yes	Yes
MELANESIA	Fiji	No	Yes
	New Caledonia	Yes	Yes
	Papua New Guinea	No	No
	Solomon Islands	Yes	Yes
	Vanuatu	No	Yes
MICRONESIA	Guam	No	Yes
	Kiribati	Yes	Yes
	Marshall Islands	No	Yes
	FSM	Yes	Yes
	Nauru	Yes	Yes
	Northern Mariana Islands	No	No
	Palau	Yes	Yes
	Totals:	**13**	**19**

Other limitations in accessing relevant information are that many data sets are unpublished and/or poorly documented. For example, it is known that artisanal catches have been surveyed in a number of countries using the TAILS app; however, these data are not well documented. Also, not all PICTs responded to the questionnaire sent to them. While 19 of the 22 PICTs acknowledged receipt of the questionnaire, only 13 sent them back completed (Table 1). Therefore, this summary is not exhaustive and is only indicative of the types of data sets and time series for coastal finfish monitoring among PICTs.

The results of the mapping exercise are presented in the following section for each PICT to provide an overview of:

- the **current data** available based on searches and consultations (survey types, years of data, an indication of whether there is temporal and/or spatial replication, and data types);
- the **use of the data** for assessment and management;
- general **internal operational characteristics** for data collection activities within each PICT, inferred from their data collection and use;
- key **local challenges** to data collection, indicated from questionnaire responses;
- **overall key characteristics** of data collections for each PICT.

Further, for each PICT current focal points are given where possible, as well as a link to the preliminary reference list of stocks based on available data:

Focal points – the details provided for individual PICT focal points (and alternates), and their accuracy, relied on the currency of available information and the responses from consultations during the project. Other than Solomon Islands, Tuvalu and Wallis and Futuna, the focal points are assumed based on information provided by FAO and individuals' responsiveness to consultations;

Reference list of stocks – for each PICT these represent the best available catch composition data for finfish species, however PICT-specific input to each list is either lacking or limited at the time of writing. The preliminary lists provided therefore represent a starting point for individual PICTs to work with.

American Samoa

Completed questionnaire received?

No.

Focal point details:

Taotasi Archie Soliai, Director, Department of Marine and Wildlife Resources (DMWR) (archie.soliai@gmail.com)

Dr. Domingo Ochavillo, Chief Fisheries Biologist, DMWR (ochavill@gmail.com)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1cYa7xH_wqgR0ews563KtyRrBoKSSamSP/edit?usp=sharing&ouid=107471911476800088418&rtpof=true&sd=true

Current data availability

There was no questionnaire response from American Samoa and so the available data were ascertained only from online searches. The only source of coastal fisheries data collection for American Samoa was from a NOAA program for conducting biological sampling from commercial fishery catches between 2010 and 2015, focusing on 10 key target species. This sampling was based on market surveys and had reasonable temporal coverage (6 years). The spatial coverage is uncertain since sampling was at a single central market (Table 2).

Table 2. Summary of coastal finfish data collected for Cook Islands based on online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Market surveys (1)	2010-15	Temporal	Species, length, number, weight, genetics, otoliths, time fishing, location

Use of data

It appears that the limited available data has not been used for stock assessments and they do not appear to have been used to inform management decision-making, although key life history parameters have been derived for two key species using the data (Sundberg et al., 2015; Taylor et al., 2018; Table 3).

Table 3. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcome	Source
Market surveys (1)	For selected species: growth, age & size at maturity, mortality	No, as baseline	No	Sundberg et al., 2015; Taylor et al., 2018

Operational characteristics

It appears that the collection of coastal finfish data in American Samoa is limited and local capacity is uncertain.

Key characteristics

- Limited coastal finfish fisheries data.
- No examples of data collection resulting in management outcomes.
- Uncertainty in local challenges and capacity.

Cook Islands

Completed questionnaire received?

Yes.

Focal point details:

Stella Marsters, Cook Islands Ministry of Marine Resources (s.marsters@mmr.gov.ck)

Koroa Raumea, Cook Islands Ministry of Marine Resources (K.Raumea@mmr.gov.ck)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1xwC9KniUfKfd4-PMWu1GZG_vxXy0Ta9E/edit?usp=sharing&ouid=107471911476800088418&rtpof=true&sd=true

Current data availability

The main source of coastal fisheries data collection are underwater visual surveys that are reported to have been conducted since the 1970s, however are also reported to be sporadic during that time limited by funding availability. These surveys have been conducted through the local Ministry of Marine Resources and based on questionnaire responses more precise detail on the temporal and spatial coverage is uncertain. The only other reported data collection was from the *Pacific Regional Oceanic and Coastal Fisheries Development Programme* (PROCFish/C) conducted in the Cook Islands during 2007-08, primarily using external experts. This project conducted underwater visual surveys in 2007, and household socio-economic surveys during 2008. Although these surveys had reasonable spatial coverage across 4 island groups, they were only conducted in one year each providing no temporal replication (Table 4).

Table 4. Summary of coastal finfish data collected for Cook Islands based on online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (1)	2007	Spatial	Species, length, number
Underwater Visual Census (1)	Since 1970's	Uncertain	Species, length, number
Household surveys (1)	2008	Spatial	Catch (recalled), fish consumption, gears used, income, fishing behaviour

Use of data

It appears that the limited available data has not been used for stock assessments and they do not appear to have been used to inform management decision-making (Ministry of Marine Resources; Pinca et al., 2009a; Table 5).

Table 5. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcome	Source
Underwater Visual Census (2)	Density (relative abundance), biomass, average size	No	No	Ministry of Marine Resources; Pinca et al., 2009a
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	Unknown	

Operational characteristics

It appears that the collection of coastal finfish data in the Cook Islands is limited and sometimes driven by external experts.

Key characteristics

- Limited coastal finfish fisheries data.
- No examples of data collection resulting in management outcomes.
- Uncertainty in local challenges and capacity.

Fiji

Completed questionnaire received?

No.

Focal point details:

Tevita Vodivodi, Fiji Ministry of Fisheries (tevita.vodivodi@govnet.gov.fj)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1WFwWFCm4dufcUII5FE2fYYe-ITBmq7Lo/edit#gid=776922633

Current data availability

There was no questionnaire response from Fiji, who were struck down with a serious CoVid-19 outbreak during the consultation period. Therefore, available data was ascertained from online searches as well as from the local office of the *Wildlife Conservation Society* (WCS). It should be noted that the local presence of WCS in Fiji has resulted in an extremely large collection of underwater visual survey data. These can be viewed using an online dashboard (https://dashboard.datamermaid.org/), which shows 621 different sites across 29 different projects with good spatial and temporal coverage throughout Fiji. These surveys are not summarised further here, given the sheer number of surveys and the inability to efficiently interrogate the database. This would be needed to understand the potential for the data to contribute to knowledge of coastal fisheries resources given the varied nature of surveys, the different projects and their objectives. For example, the surveys include benthic surveys, coral bleaching surveys, rapid biodiversity surveys, and finfish surveys.

Since ~2002, there have been numerous other surveys conducted on coastal finfish using different survey methods, including household socio-economic surveys, market surveys, creel surveys and one dedicated biological monitoring study (Table 6). While the Fiji government has been partners in some data collections, most collections appear to be project-based operated by experts from local organisations. These surveys also appear to provide good overall spatial coverage, however tend to be short-lived data collection programs, while information is lacking for some activities (e.g., market surveys operated by the Fiji Ministry of Fisheries - 2019, and by WCS – unknown time period). The single study that used biological sampling was conducted over a 4-year period, not for a time series of data, but to accumulate enough samples (Packard Foundation Western Pacific Program – Spawning Potential Surveys (SPS)).

Table 6. Summary of coastal finfish data collected for Fiji based on online searches, excluding the MERMAID database (https://dashboard.datamermaid.org/). N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (3)	2002/03, 2009, 2017	No	Species, length, number
Underwater Visual Census (1)	2005, 2007, 2008, 2009	Spatial, temporal	Species, length, number
Market surveys (2)	2019, ?	?	Species, length, weight, number.
Creel surveys (1)	2008/09	Spatial	Species, length, number, use, time fishing, fishing gears, fishing location, number fishing
Household surveys (3)	2007, 2016, ?	Spatial	Catch (recalled), gears, behaviour, consumption, prices/income
Biological surveys (1)	2014-18	Spatial	Species, length, number, sex, maturity

Use of data

It appears that very few stock assessments have been done using coastal finfish data in Fiji. There were only two data collections that were used for simple size-based assessments of overfishing: i) Creel surveys, implemented by WCS, assessed overfishing status for 19 finfish species using the % of the catch < length at maturity (L_m) method (low sample sizes) (Froese et al., 2004), and ii) The Packard project which used the Length Based Spawning Potential Ratio (LB-SPR) assessment method (Hordyk et al., 2015a, b; Prince et al., 2015a). Further, these data collections have either not been used to inform management of coastal finfish or, if they have, this has not been documented (Table 7).

Table 7. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Biomass, species richness	No	Unknown	Nand et al., 2020
Underwater Visual Census (1)	Biomass (species combined), species richness, species diversity	No	No	Knudby et al., 2011
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Friedman et al., 2010
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Jupiter et al., 2010
Market surveys (1)	Unknown	Unknown	Unknown	Ministry of Fisheries
Market surveys (1)	Unknown	Unknown	Unknown	Wildlife Conservation Society
Household surveys (1)	Fish consumption, catch (recalled), income from	No	Unknown	Jupiter et al., 2010

	fishing, gears used, fishing behaviour			
Household surveys (1)	Unknown	No	Unknown	Wildlife Conservation Society
Household surveys (1)	Unknown	No	Unknown	Ministry of Fisheries and Marine Resources Development
Creel surveys (1)	CPUE, catch, catch composition, proportion below size at maturity	Yes; proportion of catch < size at maturity	No	Cakacaka et al., 2010
Biological surveys (1)	Size frequency, size at maturity, SPR	Yes; SPR	Unknown	Prince et al., 2019

Operational characteristics

Fiji appears to have a good track record of data collection activities involving partnerships between government, NGOs and other civil societies. For example, projects and surveys documented on the MERMAID database were partnerships involving WCS, World Wide Fund for Nature (WWF), Fiji Ministry of Fisheries, University of the South Pacific, SPC, and/or various other local and international organisations. However, it appears that this has resulted in disparate data collections owned and housed by different individuals and organisations, other than government agencies. Further, there is little evidence that these data have been used to assess resource status and inform management decision-making.

Key characteristics

- Data collection activities tend to be project-based resulting in disparate collections.
- The vast majority of data collections are from underwater visual surveys; it is uncertain how many include coastal finfish.
- Few assessments are done using data, and are simple length-based methods where they are used.
- Data and assessment results don't appear to be used to inform management.

French Polynesia

Completed questionnaire received?

Yes.

Focal point details:

Magali Verducci, Direction des Ressources Marines (Directorate of Marine Resources; DRM) (magali.verducci@drm.gov.pf)

Marguerite Taiarui, DRM (marguerite.taiarui@drm.gov.pf)

Vaiana Joufoques, DRM (vaiana.joufoques@drm.gov.pf)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1ljKOMQJfC_NLSplPo6syJMPDByaG4zJi/edit#gid=2003379926

Current data availability

The PROCFish/C project conducted underwater visual surveys and household socio-economic surveys between September 2003 and June 2006. The spatial coverage of 5 islands/reefs was reasonable given the area of French Polynesia, however this project represents the only underwater visual surveys and socio-economic surveys. Other surveys more directly monitoring coastal finfish resources have been led by the Direction of Marine Resources and include fishing logbooks, market surveys and a recent biological project focused on 5 species (Table 8). Although fisher logbooks were implemented in 1998, the questionnaire respondents reported that compliance with the monthly reporting is very poor. Sale of fish products are reported for three major fish markets, and the data collection of these sales has been in operation since 1985 and represents a very good data time series. The market records and fisher logbooks have only been reported to the family level and it is unclear of the utility of these data for assessment, since example data and/or reports were not provided.

Table 8. Summary of coastal finfish data collected for French Polynesia based on online searches and the questionnaire responses. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (1)	2003, 2004 or 2006	Spatial	Species, length, number
Household surveys (1)	2003, 2004 or 2006	Spatial	Catch (recalled), gears, behaviour, consumption, income
Fisher logbooks	Since 1998, but poorly enforced or respected	No	Species group, catch (weight or number), fishing gear, fishing time
Market mandatory sales reporting	Since 1985	Good temporal	Family, catch weight

Biological surveys	2021	No	Species, weight, length, sex, otoliths

Use of data

No assessments of finfish populations have been conducted using the available data, despite good time series of data, but perhaps because data is often aggregated to family level groupings. The recent biological study appears to be a positive step as, according to questionnaire respondents, its goals are to assess if overfishing is occurring on 5 key target species, and impose management if necessary (Table 9).

Table 9. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Kronen et al., 2009b
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	Unknown	Kronen et al., 2009b
Fisher logbooks (1)	None	No	No	
Market surveys (1)	Catch weight	No	No	
Biological surveys (1)	Average size, size at maturity	No (planned)	Possibly	

Operational characteristics

Although there are some project-based data collections (Procfish), the long-term and more strategic data collection activities are locally led and implemented through the Direction of Marine Resources. As a French territory, this may be a function of the external support received from France.

Key challenges

Key challenges identified by questionnaire respondents were: a ***lack of political priority*** for coastal fisheries data collection, a ***lack of human resources*** and ***funding***, and ***vast distances***.

Key characteristics

- Some long-term national data collection activities are in place (fisher logbooks and market surveys), but their utility is hampered by poor compliance in monthly reporting of logbooks, and only family level data resolution for both survey methods.
- Data have historically not been used for assessment or to inform management.
- Recent biological data collection efforts appear to suggest a new direction in sampling that may better inform simple management strategies (e.g., Size limits based on size at maturity estimation).

Guam

Completed questionnaire received?

No.

Focal point details:

Jay Gutierrez, Guam Department of Agriculture (DOAG) (jay.gutierrez@doag.guam.gov)

Chelsa Munabrecht, DOAG (chelsa.munabrecht@doag.guam.gov)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1kHA8ZpkIVpXR-fc2J5Pw4fvz8EAbAO66/edit#gid=1351480584

Current data availability

There was no questionnaire response from Guam and so the available data was ascertained only from online searches, and in particular from two recent publications which used the data; one a research paper and the other an assessment report. The first publication used market data collected over one year however it was unclear of the spatial coverage (Houk et al., 2021). The second publication used data from a long-standing creel survey program that has operated since 1984 and is likely to be still running, and underwater visual surveys (Nadon et al., 2019) (Table 10). The spatial coverage of this data collection is very good, which is not surprising given the relatively small size of Guam and as a single island and a United States territory.

Table 10. Summary of coastal finfish data collected for Guam based on online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Market surveys (1)	1 (?)	?	Species, length, genetics
Creel surveys (1)	1984-2016?	Spatial, temporal	Species, fishing gear, number caught, length, weight, effort
Underwater Visual Census (1)	2009- 2017 (at least)	Spatial, temporal	Species, size number

Use of data

Given that the market surveys were used for a research paper, it is not apparent that any assessment has been conducted using these data, nor are there any apparent management outcomes. The creel survey data, along with the Underwater Visual Survey data, were used to conduct an assessment of 12 key local species using Spawning Potential Ratios (SPR), and have also been used on multiple occasions to assess changes through time in relative biomass and CPUE as evidence of overfishing (e.g., Weijerman et al, 2016) (Table 11). It is possible that management outcomes have resulted, however this was not able to be confirmed from internet searches of public-domain information.

Table 11. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Market surveys (1)	Size frequency, catch	No	No	Houk et al., 2021
Creel surveys (2)	Length frequencies, current fishing mortality rate F, F_{30}; total catch, relative biomass, CPUE	Yes; SPR; relative biomass decline	Unknown	Nadon, 2019; Weijerman et al, 2016
Underwater Visual Census (1)	Size structure, density, biomass	Yes; SPR	Unknown	

Operational characteristics

Most data collections in Guam appear to be led and managed by the government agency, the Division of Aquatic & Wildlife Resources (DAWR), in conjunction with key partners such as the National Oceanic and Atmospheric Administration (NOAA) and the University of Guam. This has proved to be successful with the long-term creel survey program and underwater visual surveys, with several research and assessment reports arising using these data.

Key characteristics

- Appears to have several data collection strategies with very good time series.
- Has the longest times series of coastal finfish data of any PICT.
- Several studies have used these data to conduct assessments using data-limited approaches; length-based SPR and biomass.
- Data collection approaches are locally led, and appear to receive strong support by large US-based organisations such as NOAA.

Kiribati

Completed questionnaire received?

Yes.

Focal point details:

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Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1MS2ztOTImOP3oX9DqMZhpiAmAhoxT6nZ/edit#gid=256027537

Current data availability

The PROCFish/C project conducted underwater visual surveys and household socio-economic surveys during 2004 and another SPC project, *Vulnerability of Coastal Fisheries to Climate Change*, conducted underwater visual surveys, creel surveys and biological sampling for five key local species during 2011-2013 (Table 12). Another household socio-economic survey was conducted during 2016 by the Kiribati Ministry of Fisheries and Marine Resources Development (MFMRD). While providing useful snapshot data, and with moderate spatial coverage, they are independent project-based surveys with very different goals, approaches and personnel. The implementation of creel surveys by MFMRD in 2013 is a significant strategic progression for local data collection. Although the surveys have limited spatial coverage, they have been conducted annually from 2013-2017, and bi-annually since then (i.e., 2019 and 2021). Unfortunately, details of this sampling program are lacking, but data are reported to be stored in the SPC coastal fisheries digital data repository (https://www.spc.int/CoastalFisheries/DataRepository/Public/Browse).

Table 12. Summary of coastal finfish data collected for Kiribati based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (2)	2004, 2011, 2013	Spatial, temporal	Species, length, number
Creel surveys (3)	2013, 2014, 2015, 2016, 2017, 2019, 2021	Spatial, temporal	Species, length, weight, number, effort
Household surveys (2)	2004; triennial since 2011	Spatial, temporal	Catch (recalled), gears, behaviour, consumption, income
Biological surveys (1; fishery-independent & markets)	2013	No	Length, weight, sex, age
Marine product (exports?) (1)	Annual since?	No	Species catch

Use of data

While there has been a range of coastal finfish data collection activities in Kiribati over the past 15-20 years, some data collections have not been used to conduct assessments on stocks, while for other data collections it is unknown if they have been used in assessments due to a lack of publicly available information. It is unknown if any of these data sets have been used in any way to inform management decisions (Table 13). Although full details on the recent creel survey program operated by the government agency MFMRD were not provided (e.g., data collection methods, spatial coverage, data collected), this data set has great potential to inform the status of Kiribati coastal resources given it is fisheries-dependent and spans a seven-year time series.

Table 13. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Species richness, species diversity, community structure, density, biomass, mean size ratio, trophic structure	No	Unknown	Siaosi et al., 2012; Kiareti et al, 2015
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Awira et al., 2008
Creel surveys (1)	CPUE, gender roles, catch composition, average length, gear selectivity, growth parameters, size structure, age structure, mortality rates	No	Unknown	Kiareti et al, 2015
Creel surveys (2)	Unknown	Unknown	Unknown	Ministry of Fisheries and Marine Resources Development (MFMRD)
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	Unknown	Awira et al., 2008
Household surveys (1)	Unknown	Unknown	Unknown	Ministry of Fisheries and Marine Resources Development (MFMRD)
Biological surveys (1; fishery-inde-pendent & markets)	Length frequency, Age frequency, VBGF growth parameters	No	Unknown	Awira et al., 2008

Operational characteristics

A large proportion of past data collections in Kiribati have been project-based involving external experts. The current creel survey program is led by the government agency MFMRD, which is a positive indication of the national government's prioritisation of coastal fisheries in Kiribati. Despite this, it is uncertain if the program is funded internally or if it is relying on external donor

funding. The recent shift to bi-annual surveys may be a consequence of low ongoing resourcing, and may be a positive sign if it represents a strategic approach to monitoring that is moving towards more cost-effective and sustainable data collection.

Key challenges

Several key challenges for ongoing and consistent coastal fisheries data collection in Kiribati were noted: a ***lack of funding*** and ***personnel***; a poorly functioning web-based ***database***; reliance on ***paper data sheets*** which significantly slows down the whole process; and challenges with data collection processes across a ***vast area with remote islands/atolls***.

Key characteristics

- Historical reliance on project-based snapshot-type data collections.
- Recent creel surveys indicate a positive strategic shift in coastal fisheries data collection.
- The use of data for assessment and to inform management decisions is very low and/or uncertain.

Marshall Islands

Completed questionnaire received?

No.

Focal point details:

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Benedict Yamamura, Chief of Coastal Fisheries, Marshall Islands Marine Resources Authority (byamamura@mimra.com)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1oO_PZ1eeW9fzfmUY4XpTJjSEDjGbCDsC/edit#gid=55167171

Current data availability

There was no questionnaire response from the Marshall Islands and so information about the available data were ascertained only from online searches. The available coastal finfish data known for Marshall Islands is based primarily on the two regional SPC projects: the PROCFish/C project conducted baseline underwater visual surveys and household socio-economic surveys during 2007 and 2008, and the *Vulnerability of Coastal Fisheries to Climate Change* project conducted underwater visual surveys in 2011, 2013 and 2018, and creel surveys and biological sampling for 3 key local target species during 2013 (Table 14). Additional species were sampled for biological material during 2018.

Table 14. Summary of coastal finfish data collected for Marshall Islands based on online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (2)	2007, 2011, 2013, 2018	Spatial, temporal	Species, length, number
Market surveys (1)	One year (?)	Spatial	Species, length, genetics
Creel surveys (1)	2013, 2018	Temporal	Highly detailed including species, length, weight, number, effort
Household surveys (1)	2008	Spatial	Catch (recalled), gears, behaviour, consumption, income
Biological surveys (1; fishery-independent & markets)	2013, 2018	Temporal	Length, weight, sex, age

Use of data

Only creel survey data and biological sampling data were used for assessments. Creel survey data assessed relative overfishing by examining the % of the catch less than the estimated length at maturity (L_m) for 2013 and 2018. Biological surveys aged local target species and, using catch

curves to estimate total mortality (Z) and derived estimates of natural mortality (M), were able to estimate fishing mortality (F) for two species. They then assessed current 'status' by comparing the current F against F_{opt}, using the Walters (2000) harvest strategy of F_{opt} = 0.5M. Both assessment methods are very simple data-limited approaches, although the latter requires the more technical approach for ageing fish using otoliths. It is unknown if any of the data collections have been used in Marshall Islands to inform management, even where assessments have been conducted (Table 15).

Table 15. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Species richness, species diversity, community structure, density, biomass, mean size ratio, trophic structure	No	Unknown	Moore et al., 2012a
Underwater Visual Census (1)	CPUE, gender roles, catch composition, average length, gear selectivity, growth parameters, size structure, age structure, mortality rates	Unknown	No	Pinca et al., 2009b
Market surveys (1)	Size frequency, catch	No	No	Houk et al., 2021
Creel surveys (1)	CPUE, gender roles, catch composition, average length, gear selectivity, growth parameters, size structure, age structure, mortality rates	Yes; % catch < Lm	Unknown	Moore et al., 2014b; Bosserelle et al., 2021
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Houk et al., 2021
Biological surveys (1; fishery-independent & markets)	Length frequency, Age frequency, VBGF growth parameters, total mortality (Z), length-at sex change, age-at-sex change	Yes. Estimation of $F_{current}$ and compared to F_{opt} (=0.5M, Walters, 2000)	Unknown	Moore et al., 2014b

Operational characteristics

From the available data on coastal finfish, Marshall Islands appear to have a strong reliance on external project-based data collections, without mechanisms to use data to inform management. Despite this, the Marshall Islands Marshall Islands Marine Resources Authority developed the *Reimaanlok: National Conservation Area Plan for the Marshall Islands* (2008), and have been working with communities to gradually move to devolve some of the monitoring and assessment for local community-based management. As well, they have recently implemented for the first time, minimum size limits for key local target species, however it is unclear how these sizes were determined.

Key characteristics

- Appears to be a reliance on external projects for data collections.
- Some simple data-limited assessment methods have been used.
- The use of data and/or assessment outputs to inform management is uncertain or has not occurred.

Federated States of Micronesia

Completed questionnaire received?

Yes.

Focal point details:

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Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1RJBe5Bmg_3t9GVbt2aBxsvDa7UUDWvKR/edit#gid=1067497532

Current data availability

There have been many different data collection activities in the Federated States of Micronesia since 1999, some have been project-based with external actors, while several have been internal projects or programs generally involving partnerships among state government agencies, local conservation NGO's (e.g., The Nature Conservancy), the University of Guam, NOAA, and the Micronesia Conservation Trust. Most have been short-term snapshot-type data collections, however there are also some limited longer-term data sets mostly associated with grouper spawning aggregations, although it appears that not every year is surveyed. More recently a state program of UVC surveys is reported to have been running since 2012 (Table 16). Spatial coverage of data collections has been variable and the disparate nature of projects means that temporal coverage is random.

Table 16. Summary of coastal finfish data collected for FSM based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (5)	Since 1999 (grouper spawning aggregations); 2005-08; 2006; 2011 & 2014; since 2012 (state program)	Spatial, temporal	Species, length, number
Market surveys (3)	One year (?); 2006; 2014-19 (to be	Spatial	Species, length, genetics

	repeated every 4-5 years		
Creel surveys (1)	2014	No	Highly detailed including species, length, weight, number, effort
Household surveys (2)	2006; 2016-?	Spatial	Catch (recalled), gears, behaviour, consumption, income
Biological surveys (2; fishery-independent & markets)	Spawning aggregation/market sampling since 2002 (ad hoc); 2014	No	Length, weight, sex, age

Use of data

Despite many different data collections, few have been used for fisheries assessments, although several have been used in research papers that provide insights into fisheries issues and potential management solutions (e.g., Cuetos-Bueno et al. 2018; Houk et al., 2015, 2021; Rhodes et al., 2007). Where assessments have been done, they have been using relatively simple data-limited methods; % of the catch < L_m was done using market survey and creel survey data in two separate projects, while the current 'status' of 4 key fishery target species were assessed by comparing the current F against F_{opt}, using the Walters (2000) harvest strategy of F_{opt} = 0.5M. From the market surveys conducted during 2006 and the assessment outputs using the % of the catch < L_m method, questionnaire respondents reported that size limits were introduced in Pohnpei. Underwater visual survey and market survey data were also reported to inform the timing of seasonal grouper bans in Pohnpei and Chuuk, respectively, based on spawning seasonality and timing of aggregating behaviour (Table 17).

Table 17. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Species richness, species diversity, community structure, density, biomass, mean size ratio, trophic structure	No	Unknown	Moore et al., 2012c
Underwater Visual Census (3)	Density (relative abundance), biomass, average size	No	No	Kronen et al., 2009a; Houk et al., 2015
Underwater Visual Census (1)	Species (3), number	No	Yes, grouper seasonal ban in Pohnpei	Pet et al., 2001
Market surveys (1)	Catch, catch composition, size frequency	Yes, % catch < Lm	Size limits in Pohnpei	Rhodes et al., 2007
Market surveys (1)	Size frequency, catch	No	No	Houk et al., 2021
Market surveys (1)	Annual catch, catch rates, catch composition	No	Unknown mostly, but reported to inform seasonal grouper ban in Chuuk	Cuetos-Bueno et al. 2018

Creel surveys (1)	CPUE, gender roles, catch composition, average length, gear selectivity, growth parameters, size structure, age structure, mortality rates	Yes, % catch < Lm	Unknown	Moore et al., 2015b
Household surveys (2)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Kronen et al., 2009a; Micronesia Challenge Socioeconomic Monitoring Plan, 2016
Biological surveys (1; fishery-independent & markets)	Length frequency, Age frequency, VBGF growth parameters, total mortality (Z)	Estimation of $F_{current}$ and compared to F_{opt} (=0.5M, Walters, 2000)	Unknown	Moore et al., 2015b

Operational characteristics

Despite a history of data collections being supported by strong local and regional partnerships, most of the data collections have been snapshot-type and project-based, with the major exception being some limited but longer-term monitoring of spawning aggregations. Questionnaire respondents indicated that an underwater visual survey program started in 2012 is intended to be a long-term annual program, while household socio-economic surveys are also reported to be conducted at regular intervals every 4-5 years from 2016. Despite these indications of a more strategic long-term approach to local coastal resource monitoring, evidence of their success and how they will inform coastal resource management is not readily available publicly.

Key challenges

The main challenge identified by questionnaire respondents is the ***lack of sustainable funding***.

Key characteristics

- Appear to be relatively well resourced with many local and regional partners.
- Strategic long-term data collections are mainly limited to a few aggregating species.
- Data have been used in only a few instances to conduct data-limited assessments.
- There has been some, albeit limited, use of data and assessment outcomes to inform fisheries management decisions.

Nauru

Completed questionnaire received?

Yes.

Focal point details:

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Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1lDdzuQdQdHwnxy3jczb3WAV8A2g4_d4W/edit#gid=2068033898

Current data availability

The PROCFish/C project conducted underwater visual surveys and household socio-economic surveys during 2005. A Biorap UVC method was used in an external project in 2013 and since 2006 it is reported that underwater visual surveys are conducted every 5 years. Two years of creel survey data and household socio-economic data have been collected and a biological sampling program has been operating since 2017 (Table 18). Temporal coverage of data collections is generally poor however spatial coverage is high, which is not surprising given the small coastline area of Nauru.

Table 18. Summary of coastal finfish data collected for Nauru based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (3)	2005; 2013 (Biorap); every 5 years since 2006	Spatial, temporal	Species, length, number
Creel surveys (1)	2013, 2017	Spatial	Species, number, weight, length, fishing method, # of fishers, time fishing, fishing costs
Household surveys (2)	2005; 2017	Spatial	Catch (recalled), gears, behaviour, consumption, income, effort
Biological surveys (1)	Since 2017	Spatial and temporal	Species, weight, length, sex, gonad weight, otoliths

Use of data

None of the coastal finfish data collections in Nauru have been used as inputs to assessments of stocks. Also, data have not been used to inform management of coastal finfish except for the collection of biological samples to estimate lengths at maturity of some species and the subsequent introduction of a minimum size limit (Table 19). Unfortunately, the details of this monitoring program are not readily available publicly.

Table 19. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (3)	Density (relative abundance), biomass, average size	No	No	The PROCFish/C and CoFish Team, 2007; McKenna et al., 2015
Creel surveys (1)	Unknown	Unknown	Unknown	Ministry of Fisheries
Household surveys (2)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	The PROCFish/C and CoFish Team, 2007
Biological surveys (1)	Size at maturity, mean size, spawning seasonality,	No	Size limits	Nauru Fisheries and Marine Resources Authority

Operational characteristics

While most of the earlier data collection activities in Nauru appear to be short time series or snapshot data sets that have tended to be externally funded projects, since ~2017 a more strategic approach to data collection appears to be emerging, with government-led programs (Nauru Fisheries and Marine Resources Authority, NFMRA) using more regularly-planned creel surveys, socio-economic surveys, and a biological sampling program with very clear goals and methods. The exception is a UVC program that started in 2006 and is reported to be conducted every five years and is also led by the NFMRA. The strategic approach to creating long term data series is a positive step and it is worth noting that the intended frequency of surveys is often not every single year, which would be more costly and difficult to sustain. While internally led data collections are also a positive sign, it is not clear how they are funded and whether the funding source is stable or will be maintained over time.

Key challenges

Key challenges identified by questionnaire respondents were: a ***lack of staff and resources***, ***lack of staff skills*** (e.g., conducting surveys, and particularly data analysis), staff dedication, and the unwillingness of some fishers to participate in creel surveys.

Key characteristics

- Historical data collections appear to rely on external projects, with generally poor temporal coverage of data but good spatial coverage.
- Recent data collections are being led by the Nauru government with what appears to be a more deliberate and strategic approach.
- Data have not been used historically to conduct assessments of stocks.
- Only recently does it appear that data collections have informed management decisions.

New Caledonia

Completed questionnaire received?

Yes.

Focal point details:

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Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1b9C6EQxzp-hoV2rkkgVnnQ6_bu3d1xKQ/edit#gid=1302118712

Current data availability

The PROCFish/C project conducted underwater visual surveys and household socio-economic surveys during 2004. Compulsory logbooks for commercial fishers have been in place since 1992, providing a potentially valuable data set for assessing stock status, depending on the detail reported and the data quality. Another long-term data set is market surveys since 1991 however this data set has only collected price data. Only more recently (2020 and 2021) has New Caledonia implemented what appears to be more strategic data collections that are intended to continue annually: biological sampling to estimate life history parameters for selected key target species, and market surveys to monitor catch and effort (Table 20).

Table 20. Summary of coastal finfish data collected for New Caledonia based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (1)	2004	Spatial	Species, length, number
Household surveys (1)	2004	Spatial	Catch (recalled), gears, behaviour, consumption, income, effort
Market surveys (2)	Since 1991*; 2020	Temporal*	Prices*; catch, length, weight
Biological sampling (2)	2020; 2021		Species, number, length, weight, genetics, gonads, otoliths
Fisher logbooks (1)	Since 1992	Spatial and temporal	Species/groups/families, catch, effort, fishing area, fishing times, fishing costs, revenues

*The long-term data set apparently is only of price data.

Use of data

No stock assessments have been done on coastal finfish species in New Caledonia using available data, however questionnaire respondents indicated that very recent data collections will be used for "*fish regulation adaptation*". This is very non-specific and it is therefore uncertain if data are used to inform management (Table 21).

Fisher logbooks have been implemented since 1992 and, although information on the level of compliance and enforcement is not readily available publicly, data from the logbooks are assessed against a harvest strategy using CPUE as an indicator of the status of the resource, and monitored against reference levels. In the event that the indicator drops significantly below historical levels (the red zone), it triggers actions to assess in more detail the stock status and, if necessary, to apply more conservative management such as reducing catch (see *https://www.zoneco.nc/documents/developpement-dune-bdd-et-de-ses-indicateurs-de-gestion-pertinents-pour-le-suivi-de-la*). This harvest strategy indicates relatively high local capacity, which is possibly a function of external support as a French territory.

Table 21. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Kronen et al., 2009c
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Kronen et al., 2009c
Market surveys (2)	Price history; catch composition, size frequency	No	*"Fish regulation adaptation"*	
Biological sampling (2)	Average size, size frequency, catch composition, length-weight relationship, size at maturity	No	*"Fish regulation adaptation"*	
Fisher logbooks (1)	Catch history, CPUE, catch composition, fishery economics	Yes, CPUE trends against reference points	Harvest strategy in place (see text)	Attached document "Synthèse rapport N. Guillemot"

Operational characteristics

While there have been limited project-based data collection activities in New Caledonia, most of the significant data collections for coastal finfish are led by national government agencies including some very long-term data collections. While it is uncertain of the utility of that data, government have recently implemented further relevant data collections that appear to be strategic with the intention for annual continuation.

Key challenges

The main challenges identified by questionnaire respondents were: fishers ***not returning logbooks***, ***lack of human resources*** and the ***irregularity of landings***.

Key characteristics

- Most of the past data collections are internally led, although the utility of the data is uncertain.
- The inclusion of a harvest strategy linked to the commercial fisher logbook indicates a relatively high technical capacity.
- Fisher logbooks may represent a significant time series dataset (details of consistency uncertain), otherwise temporal coverage is generally lacking.

Niue

Completed questionnaire received?

No.

Focal point details:

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Dr Josie Tamate, Director General, Ministry of Natural Resources (josie.tamate@mail.gov.nu)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1Cnf-F8ApanruhzvRDT-xV94jLeS-gNHg/edit#gid=351246028

Current data availability

The PROCFish/C project conducted underwater visual surveys and household socio-economic surveys in Niue during 2005, which had good spatial coverage and represents a reasonable snapshot data set. An earlier project in 1998 conducted underwater visual surveys at one location to assess a recently implemented marine reserve by doing surveys inside and outside the reserve (Labrosse et al., 1999) (Table 22).

Table 22. Summary of coastal finfish data collected for Niue based on online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (2)	1998; 2005	Some spatial	Species, length, number
Household surveys (1)	2005	Spatial	Catch (recalled), gears, behaviour, consumption, income, effort

Use of data

It appears that no assessments have been conducted based on available coastal finfish data and management outcomes are also not apparent (Table 23).

Table 23. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (2)	Density (relative abundance), biomass, average size	No	No	Labrosse et al., 1999; Kronen et al., 2008a

Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Kronen et al., 2008a

Operational characteristics

All data collections in Niue appear to be project-based, therefore providing limited temporal coverage of data sets. This makes impacts assessments difficult as noted by Fisk (2007): "*Inconsistency in survey methodologies in previous studies hinders assessment of long-term resource trends*." The reliance on external projects may reflect limited local capacity.

Key characteristics

- Appears to be a reliance on external projects for data collections.
- Limited data collections have not been used for assessment nor to inform management.

Northern Mariana Islands

Completed questionnaire received?

No.

Focal point details:

Unknown. Possibly Manuel M. Pangelinan, Division of Fish and Wildlife, Department of Lands and Natural Resources (DLNR) (mpangelinan.cnmidfw@gmail.com)

Preliminary reference list of stocks

No catch composition data located.

Current data availability

There was no questionnaire response from Northern Mariana Islands and so the available data was ascertained from a single published research paper that examined density dependent responses across different coral reef fish phylogenies (Houk et al., 2021). This paper suggested that market data was collected over what appears to be one year from two islands (Saipan and Tinian) (Table 24).

Table 24. Summary of coastal finfish data collected for Northern Mariana Islands based on online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Market surveys (1)	One year	Spatial	Species, length, number, genetics

Use of data

The limited data has been used for research purposes but apparently not for assessment or to directly inform management in the Commonwealth of the Northern Mariana Islands (Table 25).

Table 25. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Market surveys (1)	Size frequency, catch	No	No	Houk et al., 2021

Operational characteristics

From the limited examples, data collection appears to be limited to project-based funding.

Key characteristics

- Limited data for coastal finfish is apparent, with no examples of assessment or use for management.

Palau

Completed questionnaire received?

Yes.

Focal point details:

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Scherryl Solang, Data specialist, Bureau of Marine Resources (delalou@gmail.com)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1O_rpUpzYqIOUJS8P5I2tn8M_83a6JZdG/edit#gid=1831630186

Current data availability

Although there have been a large number of data collection activities using different survey methods over the past ~30 years, the vast majority have been snapshot-type and project-based. Therefore, although spatial coverage is good for many, temporal coverage for these project-based data collections is generally poor. Some of the largest data collections have been SPC-led projects using underwater visual surveys and household socio-economic surveys (Procfish, 2007) and creel surveys and biological sampling (Scientific Support for the management of Coastal and Oceanic Fisheries in the Pacific Islands region; SciCOFish) project, 2014/15). Two notable data collections that have a long time series are both led by the government agency, Palau Bureau of Marine Resources (BMR). One is a mandatory reporting of all marine exports which ran from 1994-2020 until export of coastal finfish was banned in 2020 (https://www.palaugov.pw/wp-content/uploads/2020/04/RPPL-No.-10-54.pdf). The second, according to questionnaire respondents, was a market survey program that ran from 1990-2011 and included three major fish markets (Table 26). Notably, it appears that recent data collection activities have not been in place.

Table 26. Summary of coastal finfish data collected for Palau based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (1)	2007	Spatial	Species, length, number
Household surveys (1)	2007	Spatial	Catch (recalled), gears, behaviour, consumption, income
Market surveys (4)	1990-2011; 2015	Spatial and temporal	Species, length, number, effort
Marine export declaration	1994-2020[#]	Spatial and temporal	Species, weight, quantity
Creel surveys (1)	2014	No	Species, length, number, effort
Biological surveys (2)	2012-16; 2015	Spatial	Species, length, weight, number, sex, maturity, age

[#]Export of coastal finfish was banned during 2020 (https://www.palaugov.pw/wp-content/uploads/2020/04/RPPL-No.-10-54.pdf).

Use of data

It appears from the available data and their use, that the collection and use of coastal finfish data in Palau is not very strategic and does not appear to inform fisheries management decision-making, routinely or otherwise. The only exception in evidence was the use of coastal reef fish catch volumes exported, derived from the mandatory marine export declaration, as part of decision-making to ban their export since 2020 (https://www.palaugov.pw/wp-content/uploads/2020/04/RPPL-No.-10-54.pdf). Some assessments using these data have been conducted, all by external short-term projects, and all using relatively simple data-limited methods. All used length-based methods except for one project that used an age-based method to assess the current 'status' of 5 key fishery target species by comparing the current F against F_{opt}, using the Walters (2000) harvest strategy of F_{opt} = 0.5M (Table 27).

Table 27. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Friedman et al., 2008a
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Friedman et al., 2008a
Market surveys (1)	Size frequency, catch	No	No	Houk et al., 2021
Market surveys (1)	Catch composition, length frequency, average length, CPUE	No	No	Lindfield, 2016
Market surveys (1)	Growth parameters, mortality rates, recruitment parameters, YPR, size frequency, catch composition, Annual catch (1976-1990; market receipt books)	Yes, ELEFAN	No	Kitalong and Dalzell, 1994
Market surveys (1)	n.a.	Unknown	n.a.	Bureau of Marine Resources (BMR)
Marine export declaration	Total exports	No	Yes, (Ban of coastal finfish exports)	Bureau of Marine Resources (BMR)
Creel surveys (1)	CPUE, average catch, length frequency	Yes; % of catch < size at maturity	No	Moore et al, 2015c
Biological surveys (1)	Length frequency, age frequency, growth, Z (catch curves), length at maturity, age at maturity	Yes; $F_{current}$ compared to $F_{optimum}$	No	Moore et al, 2015c
Biological surveys (1)	Size frequency, size at maturity, SPR	Yes; Spawning Potential Ratios (SPR)	Unknown	Prince et al, 2015b

Operational characteristics

Data gathering activities have generally been driven by the national fisheries management agency, the Bureau of Marine Resources (BMR), and in partnership with external organisations such as SPC. Due to the opportunistic nature of these activities, it appears there are no local staff permanently assigned to data collection activities, relying more on external funding. Data are stored on a local server using either a MS Access database or MS Excel. Key clients for reporting project outcomes have been BMR and National Congress. Only the national export data have historically been reported to the National Statistics Office.

Key challenges

The two key challenges for ongoing and consistent coastal fisheries data collection in Palau, as indicted by questionnaire respondents, are a ***lack of funding*** and a ***lack of personnel***. These two issues underpin many of the constraints well summarised in the Palau Annual report 2017, which highlights the ***lack of local technical expertise and facilities*** (BMR, 2019; pp67-68.).

Key characteristics

- Some simple stock assessment conducted, all by external partners.
- No examples of data collection resulting in management outcomes.
- Reliant on partnerships and external funding.
- Internal reporting only

Papua New Guinea

Completed questionnaire received?

No.

Focal point details:

Unknown.

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1lasMkow-Ob4Cn8Ik1FQnqqDaUT9c2sB-/edit#gid=2048116708

Current data availability

There was no questionnaire response from Papua New Guinea and so the available data were ascertained only from online searches. Based on the readily accessible information on data collection activities for coastal finfish resources in Papua New Guinea (PNG), there have been three key external projects conducted in different discrete areas from 2006-2014. The PROCFish/C project conducted underwater visual surveys and household socio-economic surveys during 2006; the Vulnerability of Coastal Fisheries to Climate Change project conducted underwater visual surveys, creel surveys and biological sampling for 3 key local species during 2012-2014; and Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) led the '*Characterization of the traditional fisheries in the Torres Strait Treaty communities, Papua New Guinea*' project, which used a combination of creel surveys, household surveys and market surveys (Table 28). Another external project is known to have been in operation for the past several years led by WWF and collecting coastal finfish data to assess stock status using the SPR method. Information on this project is not readily available publicly, and so is not included here.

Table 28. Summary of coastal finfish data collected for PNG based on online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (2)	2006, 2012, 2014	Spatial OR temporal	Species, length, number
Creel surveys (2)	2013, 2014	No	Highly detailed including species, length, weight, number
Household surveys (2)	2006, 2013	Spatial	Catch (recalled), gears, behaviour, consumption, income, effort
Market surveys (1)	2012/13	No	Species, number caught, weight, length, fishing gear, fishing area

Use of data

It appears that the available data in PNG are rarely used for assessment or to inform management (Table 29). This may be influenced by the project-based nature of data collections.

Table 29. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Species richness, species diversity, community structure, density, biomass, mean size ratio, trophic structure	No	Unknown	Moore et al., 2012b, 2015a
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Friedman et al., 2008b
Creel surveys (1)	CPUE, gender roles, catch composition, average length, gear selectivity, growth parameters, size structure, age structure, mortality rates	No	Unknown	Moore et al., 2015a
Creel surveys (1)	Daily catch, annual catch, CPUE, length frequency	No	No	Busilacchi et al., 2015
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Friedman et al., 2008b
Household surveys (1)	n.a.	No	No	Busilacchi et al., 2015
Market surveys (1)	Daily catch, annual catch, CPUE, length frequency	No	No	Busilacchi et al., 2015
Biological surveys (1)	CPUE, gender roles, catch composition, average length, gear selectivity, growth parameters, size structure, age structure, mortality rates	Yes; $F_{current}$ compared to $F_{optimum}$	Unknown	Moore et al., 2015a

Operational characteristics

There appears to be a heavy reliance on externally funded projects for coastal finfish data collections in PNG. However, given the size of PNG, there may be government-led data collections that are not readily available publicly. Unfortunately, no questionnaire response was received that may have provided more insight on this.

Key characteristics

- Few examples of stock assessments and only using very simple methods, all by external partners.
- No examples of data collection resulting in management outcomes.
- Appears to be reliant on partnerships and external funding.
- No response during consultations.

Pitcairn Islands

Completed questionnaire received?

No.

Focal point details:

Unknown.

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/14WaptxQY0skgC3HKJrl7_ygdY5YQzdi2/edit#gid=1314180863

Current data availability

There was no response to the questionnaire from the Pitcairn Islands and only one study was located online (Table 30). This was limited to a one-off student project led by the Imperial College in London, UK, and used Baited Remote Underwater Video methods to assess the abundance, biomass and richness of species found in waters around Pitcairn Island (Duffy, 2014).

Table 30. Summary of coastal finfish data collected for Pitcairn Islands based on online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Baited Remote Underwater Video (1)	2014	Spatial	Species, length, number

Use of data

The only available data in Pitcairn Islands provides a useful baseline and was not used for assessment nor to inform management, except to inform the feasibility of a commercial fishery for several species (Table 31).

Table 31. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Baited Remote Underwater Video (1)	Species richness, biomass, abundance, mean size	No	Unknown	Duffy, 2014

Operational characteristics

There appears to be very little data collection activity in Pitcairn Islands for coastal finfish stocks. Unfortunately, no questionnaire response was received that may have provided more insight on this, however being a very small and isolated country may reflect low levels of human resourcing.

Key characteristics

- Only one external data collection identified, with no apparent assessment or management outcomes.

- Small size and isolation may reflect low levels of resourcing and capacity for locally led data collection.

Samoa

Completed questionnaire received?

Yes.

Focal point details:

Aliimuamua Malaefono Taua-Faasalaima, Samoa Bureau of Statistics (malaefono.taua@sbs.gov.ws)

Sapeti Tiitii, Ministry of Agriculture and Fisheries (MAF) (sapeti.tiitii@maf.gov.ws)

Magele Etuati Ropeti, National project coordinator, Ministry of Agriculture and Fisheries (MAF) (magele.ropeti@maf.gov.ws)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1BUF47tQP0MbJ922cxxiolWYiZ1EELhDL/edit?usp=sharing&ouid=107471911476800088418&rtpof=true&sd=true

Current data availability

The PROCFish/C project conducted underwater visual surveys and household socio-economic surveys during 2005 in Samoa. Other than this project, data collation activities have been locally led through the Samoa Fisheries Division of the Ministry of Agriculture and Fisheries (MAF) and include long-term data programs that are still current. These excellent time series data include annual market surveys (2005-2020), annual underwater visual surveys involving villages involved in the Community-Based Fisheries Management Program (CBFMP)(1995-2020), and household socio-economic surveys that have been conducted every 5-10 years since 2013 (Table 32). These locally run data collection schemes have very good temporal and spatial coverage and have the potential to be valuable and robust data sources for assessments of local stocks.

Table 32. Summary of coastal finfish data collected for Samoa based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (2)	1995-2020; 2005; 2017	Spatial and temporal	Species, length, number
Household surveys (2)	2005; 2013	Spatial, some temporal	Catch (recalled), gears, behaviour, consumption, income, effort
Market surveys (1)	2005-2020	Spatial and temporal	Species, length, weight, number, effort

Use of data

While questionnaire respondents indicated that local MAF-led program data were used for assessments, the assessment method was not given and so the level and scope of assessment remains uncertain. These same programs were reported to inform management, mostly in terms of size limits (market surveys), and for strengthening and reviewing effectiveness of the CBFMP

(UVC and household surveys) (Table 33). More specific information was not able to be obtained during the project.

Table 33. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Vunisea et al., 2008
Underwater Visual Census (1)	Average size, species and family composition, density, biomass	Yes[#]	Yes	Samoa Fisheries Division-MAF
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Vunisea et al., 2008
Household surveys (1)	Species and size distribution, species by habitats, average catch by gender	Yes[#]	Yes	Tiitii et al, 2014
Market surveys (1)	average size, species composition, price/kilo, average weight, total value, total volume	Yes[#]	Yes, size limits?	Samoa Fisheries Division-MAF

[#] Questionnaire respondents indicated that for each of the three locally implemented data collections using different methods, the data were used for stock assessment. Limited details were provided except for the published socio-economic report (Tiitii et al., 2014) which did not provide evidence that the data were used in assessments nor to inform management. Further details would be needed to understand the type and scope of any assessments.

Operational characteristics

It appears that Samoa has a reasonable level of capacity for implementing and maintaining sustainable and meaningful data collection programs for coastal finfish species, as evidenced by two long-term programs in particular, that have been running for 26 years (UVC) and 16 years (market surveys). It remains unclear as to the nature and scope of how data are used for assessment and to inform fisheries management.

Key challenges

The main challenge identified for ongoing and consistent coastal fisheries data collection in Samoa are resources (***funding*** and ***expertise***) required to manage and safeguard data collection, e.g., computers, improvements in the existing database and back-up systems.

Key characteristics

- Samoa is not reliant on external projects and internally lead long-term and relevant data collection programs.
- The extent that assessment methods are used in Samoa remains uncertain.

Solomon Islands

Completed questionnaire received?

Yes.

Focal point details:

Paul Tua, Chief Research Officer, Ministry of Fisheries and Marine Resources (PTua@fisheries.gov.sb)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1w_EoLlWUgWMm-ah4EKyBn4fdu5DCnh_e/edit#gid=751736440

Current data availability

Limited data collections were identified for coastal finfish in the Solomon Islands and most were external project-based with limited temporal coverage. The PROCFish/C project conducted underwater visual surveys and household socio-economic surveys during 2006, while another external project conducted biological sampling with communities to assess stock status across the period 2014-18 (Prince et al., 2020). Another locally led market survey (SI Ministry of Fisheries and Marine Resources) was indicated by the questionnaire respondents however it is uncertain when this was conducted or for how long. (Table 34).

Table 34. Summary of coastal finfish data collected for Solomon Islands based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (1)	2006	Spatial	Species, length, number
Household surveys (1)	2006	Spatial	Catch (recalled), gears, behaviour, consumption, income, effort
Market surveys (1)	?	?	Species, length, fishing methods, fishing location
Biological surveys (1)	2014-18	No	Species, length, number, sex, maturity

Use of data

The only data collection used to conduct an assessment was an external project aimed at testing the use of Spawning Potential Surveys (SPR). It is unknown if outcomes from the assessment were used to inform local management decisions. Data from the Procfish project were not used for assessment or management, and it is unknown how data from the local market surveys were used (Table 35).

Table 35. Summary of metrics derived from data collections and their use in informing management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census 1)	Density (relative abundance), biomass, average size	No	No	Pinca et al., 2008
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Pinca et al., 2008
Market surveys (1)	Catch composition, Other unknown	Unknown	Unknown	Ministry of Fisheries and Marine Resources
Biological surveys (1)	Size frequency, size at maturity, SPR	Yes; SPR	Unknown	Prince et al., 2020

Operational characteristics

There appears to be a heavy reliance on externally funded projects for coastal finfish data collections in the Solomon Islands. This may reflect a lack of human resourcing as well as a lack of capacity.

Key challenges

The main challenge for ongoing and consistent coastal fisheries data collection in Solomon Islands is a ***lack of funding*** for continued routine monitoring programs across ***multiple remote sites***.

Key characteristics

- Appears to be mostly reliant on external projects for data collections.
- No long-term data collections for coastal finfish are evident.
- The use of data for assessment and management is also not evident.

Tokelau

No questionnaire was completed however their response was that no surveys of coastal finfish species are done due to the limited local capacity (human, financial, technical), within the large area of their 3 main atolls.

The focal point is unknown but may be: Feleti Tulafono, Director, Fisheries Management Agency (FMA) (ftulafono@gmail.com)

Tonga

Completed questionnaire received?

Yes.

Focal point details:

Siola'a Malimali, National project coordinator, Head of Fisheries Science Division (s.malimali@tongafish.gov.to; siolaamalimali@gmail.com)

Poasi Fale Ngaluafe, Tonga Ministry of Fisheries (poasi.ngaluafe@tongafish.gov.to)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1kaF6fB5fXezWYMPUDKEDKAIl00FZUk6b/edit#gid=433560074

Current data availability

A range of different survey types have been used in Tonga for coastal finfish data collections (Table 36). The PROCFish/C project conducted underwater visual surveys and household socio-economic surveys during 2008, while another external project conducted by the Secretariat of the Pacific Regional Environment Programme (SPREP) in 2014 conducted UVC as part of a biodiversity project. Other than these projects, more recent data collections have had the Tonga Government's Ministry of Fisheres (MoF) as the lead agency or as a partnership with other organisations (SPC or the Vava'u Environmental Protection Association, VEPA). Several of these data collections appear to be associated with the establishment of special management areas under a national community-based management resource approach. More recent household surveys have also been conducted by the MoF over more than one year (2015 & 2020); however, it is unclear if they are intended to continue as routine monitoring as several past programs appear to have run for 3 years and then stopped (UVC, creel surveys, market surveys; Table 36).

Table 36. Summary of coastal finfish data collected for Tonga based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (3)	2008; 2014; 2019, 2020, 2021	Some spatial and temporal	Species, length, number
Household surveys (2)[#]	2008; 2015, 2020	Spatial	Catch (recalled), gears, effort, behaviour, consumption, income
Creel surveys (1)	2015, 2016, 2017	Spatial and temporal	Species, length, catch (number), effort
Biological sampling (1)	2014	No	Species, length, age
Market surveys (1)	2014, 2015, 2016	Spatial and temporal	Species, length, number, weight, prices

[#]The latter household surveys (2015, 2020) only collected effort level data, and family level data (according to respondent).

Use of data

For most data collections, data have not been used for assessments and have not informed management outcomes. Questionnaire respondents indicated that creel survey and UVC data were used for assessments and to inform management (creel surveys), however there was insufficient detail to understand the assessment method and specific management outcomes. The MoF/SPC partnership using biological sampling did document the use of this data using an age-based method to assess the current 'status' of 3 key fishery target species by comparing the current F against F_{opt}, using the Walters (2000) harvest strategy of F_{opt} = 0.5M (Table 37). They also used a simple size-based assessment using the % of the catch < L_m (Moore & Malimali, 2016). This same study derived local estimates of size and age at 50% and 95% maturity for 4 key target species.

Table 37. Summary of metrics derived from data collections and their use in informing management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Atherton et al, 2014
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Friedman et al., 2009
Underwater Visual Census (1)	Density, biomass	Yes?	No	Ministry of Fisheries (MoF) and VEPA (NGO)
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Friedman et al., 2009
Household surveys (1)	n.a.	No	No	Ministry of Fisheries (MoF) and VEPA (NGO)
Creel surveys (1)	Average size, CPUE, catch composition	Yes[#]	Yes[#]	Ministry of Fisheries (MoF)
Biological sampling (1)	Length frequency, age frequency, size at maturity, age at maturity, mortality (Z - catch curves), M and F	Yes; $F_{current}$ compared to $F_{optimum}$, and % catch < Lm	Yes[#]	Moore & Malimali, 2016

[#] Questionnaire respondents indicated that stock assessments were used to derive size limits as management outcomes, suggesting a lack of understanding in the definition of a stock assessment. Further, searches of recent coastal fisheries regulations in the Kingdom of Tonga indicate that finfish size limits have not yet been implemented.

Operational characteristics

Tonga have shown promise in recent years for leading data collection programs across years, and to develop partnerships to help achieve this. It is not apparent if they have a clear strategy for data collection that informs assessment and management over the medium-long term with the use of a variety of different survey types and assessments relying on external partners.

Key challenges

The key challenges for ongoing and consistent coastal fisheries data collection in Tonga are a ***lack of funding***, ***lack of personnel*** and ***limited capacity*** for data reporting.

Key characteristics

- Time series of data collections are only emerging in recent years.
- Evidence of the use of data for assessment and management is lacking.
- Indications in recent years are that coastal finfish management in Tonga is becoming more organised, though uncertainty exists in the strategic direction.

Tuvalu

Completed questionnaire received?

Yes.

Focal point details:

Mr Lale Petaia, Tuvalu Department of Fisheries, Ministry of Fisheries and Trade (tafauli7@gmail.com)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1lpGKm0if7whdenY9WEv-8dsECX-w9Hz2/edit#gid=892785075

Current data availability

The available data in Tuvalu is derived from two key SPC-led projects, and a locally led project. The PROCFish/C project conducted baseline underwater visual surveys and household socio-economic surveys during 2004, and the Vulnerability of Coastal Fisheries to Climate Change project conducted underwater visual surveys in 2011 and 2013, and creel surveys and biological sampling for 3 key local target species also during 2013. Through the national fisheries department, Tuvalu has also developed, implemented and led a creel survey program that has persisted since 2015 (Table 38), with good spatial coverage across all the main islands. This creel survey program is mostly externally funded under the Pacific Islands Regional Oceanscape Program (PROP). Under this latter project, the fisheries department are currently collecting relevant reproductive data to estimate size at maturity for key local target finfish species, with a goal to establish appropriate size limits.

Table 38. Summary of coastal finfish data collected for Tuvalu based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (2)	2004, 2011, 2013	Spatial and temporal	Species, length, number
Household surveys (1)	2004	Spatial	Catch (recalled), gears, behaviour, consumption, income, effort
Creel surveys (2)	2013; 2015-2021	Spatial and temporal	Highly detailed including species, length, weight, number, effort
Biological surveys (1; fishery-independent & markets)	2013	No	Length, weight, sex, age

Use of data

The majority of data collections have not been used for assessments of stocks (Table 39). Where they have been used, methods were an age-based method to assess the current 'status' of 3 key fishery target species by comparing the current F against F_{opt}, using the Walters (2000) harvest strategy of F_{opt} = 0.5M and conducted by external experts. Importantly, the locally implemented

creel survey program has routinely (annually) used a simple size-based assessment using the % of the catch < L_m, with the support of an external fisheries expert (Alefaio et al., 2016, 2018). Data have either not been used to inform management, or it is uncertain if they have. It is a concern that the creel survey program has identified that many species are consistently below their limit reference point and yet no management intervention has occurred.

Table 39. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Species richness, species diversity, community structure, density, biomass, mean size ratio, trophic structure	No	Unknown	Siaosi et al., 2012
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Sauni et al., 2008
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Sauni et al., 2008
Creel surveys (1)	CPUE, gender roles, catch composition, average length, gear selectivity, growth parameters, size structure, age structure, mortality rates	No	Unknown	Moore et al, 2014
Creel surveys (1)	Average size, Size at maturity, Catch composition, CPUE, Density and Biomass	Yes, % catch < Lm	No	Alefaio et al., 2016, 2018
Biological surveys (1)	Length frequency, Age frequency, VBGF growth parameters, total mortality (Z), length-at sex change, age-at-sex change	Yes. $F_{current}$ compared to F_{opt} (=0.5M, Walters, 2000)	Unknown	Moore et al, 2014

Operational characteristics

Historically, the majority of Tuvalu's data collections have been from snapshot-type projects that are externally funded and implemented. More recently, a more strategic local approach has seen a time series of creel survey data accumulated, that includes two key indicators (% catch < Lm and CPUE) and reference points to guide management responses. This is a positive step, while acknowledging that the program is still reliant on external experts and management actions appear to have not been taken under the programs harvest strategy.

Key challenges

The key challenges for ongoing and consistent coastal fisheries data collection in Tuvalu are a ***lack of equipment, funding constraints***, poorly functioning database and a ***lack of personnel***.

Key characteristics

- Tuvalu has a strong reliance on external funding support that is now focused in a strategic data collection program.
- Limited resources are focused on a single data collection approach designed to meet local management needs.
- Management outcomes are yet to be realised even though limit reference points have been exceeded using current assessments.

Vanuatu

Completed questionnaire received?

No.

Focal point details:

June Brian Molitaviti, Manager, Research & Aquaculture Division, Vanuatu Fisheries Department (jbmolitaviti@vanuatu.gov.vu)

Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/10o0gUX6uhSzakZqP0x072Ga4Kw9GtOty/edit#gid=1839549438

Current data availability

There was no questionnaire response from Vanuatu. The available data in Vanuatu are largely attributable to the PROCFish/C project which conducted baseline underwater visual surveys and household socio-economic surveys during 2003. Other recent data collections were by this consultant during 2016 and 2017 (North Efate) and 2019 (Tanna) for underwater visual surveys, and from 2017-2021 across 4 islands for creel surveys (Table 40). It is known that the Vanuatu government have been using the TAILS app for collection of some coastal finfish catch data (mostly aggregated) in recent years, and other opportunistic project-based data collections exist, however this information is not readily available.[1]

Table 40. Summary of coastal finfish data collected for Vanuatu based on online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (3)	2003, 2016, 2017, 2019	Spatial and temporal	Species, length, number
Household surveys (1)	2003	Spatial	Catch (recalled), gears, behaviour, consumption, income, effort
Creel surveys (1)	2017-2021	No	Family, length, number, fishing location, fishing time, # fishing, gear used

Use of data

Most of the data collections have not been used for assessments of stocks and where they have been used, it has been the very simple length-based method of *% of the catch > the size at maturity* of selected species (Table 41). For the locally implemented community-based creel surveys this same simple assessment method is incorporated into the data collection process with direct links to relevant management options (Johnson et al., 2020). The program, although opportunistic and therefore *ad hoc* in nature, are conducted by trained community members and

[1] Following the data mapping exercise and during the FAO SDG14.4.1 workshop training series, it was learned that VFD have recently (2020-21) begun collecting coastal fisheries data using creel surveys at selected sites.

have resulted in demonstrable changes in local management despite the fact that finfish data are recorded only to family level.

Table 41. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Friedman et al., 2008c
Underwater Visual Census (1)	Density (relative abundance), average size	No	No	Welch, 2016;
Underwater Visual Census (1)	Density (relative abundance), average size	Yes; size frequency relative to Lm	Yes; informed local management plan and numerous management measures (see p.46 of report)	Welch et al., 2019
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Friedman et al., 2008c
Creel surveys (1)	Average size, catch composition, size frequency, CPUE	Yes; % catch > Lm	Yes; Sunae village: ban parachute net, introduction of minimum gillnet mesh size, introduction of minimum hook size	Johnson et al., 2020

Operational characteristics

Historically, the majority of Vanuatu's data collections have been from snapshot-type projects that are externally funded and implemented. As such, most of the available data collection activities have required external expert input and guidance. Use of the TAILS app is implemented by the Vanuatu Fisheries Department (VFD), however it was designed to monitor offshore coastal fishing and its utility for informing coastal resource status and management has not yet been demonstrated. Most historical data collection activities do not appear to be strategically developed for informing management of coastal finfish stocks. A local community-based creel survey program has shown the capacity to create improved management at the village scale; however, this program has no ongoing funding for training and development that would provide a more useful broader scale time series.

Key characteristics

- Vanuatu appears to have a strong reliance on external funding support for data collection programs.
- Limited resources and a lack of a strategic approach means poor data time series and continuity in collection activities.
- Assessments have been used in some instances to inform if overfishing is occurring, but only using very simple assessment methods.
- A community-based creel survey program has shown promise with data used for assessment and resulting in management changes but also lacks continuity.

Wallis and Futuna

Completed questionnaire received?

Yes.

Focal point details:

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Preliminary reference list of stocks

https://docs.google.com/spreadsheets/d/1WrIgoU9rrCZM0O7iFsJdTfpj0hHkS2iY/edit#gid=651864279

Current data availability

The available data in Wallis and Futuna include baseline underwater visual surveys and household socio-economic surveys conducted as part of the PROCFish/C project during 2005, as well as other data collection programs that are locally implemented with some running for many years and providing potentially very useful time series data. For example, professional fishers have had to complete mandatory logbooks of their catch and effort for the last 15 years; underwater visual surveys have been conducted for 20 years (in most years); and household surveys have been conducted every five years for the past 20 years. Approximately one year ago the government also introduced weekly creel surveys as part of a program that is intended to become annual (Table 42).

Table 42. Summary of coastal finfish data collected for Wallis and Futuna based on survey responses and online searches. N.B. for each survey type, the number of projects is given in parentheses.

Survey type	Years of data	Replication	Data type
Underwater Visual Census (2)	2005; past 20 years	Spatial and temporal	Species, length, number
Creel surveys (1)	2020	Spatial	Species, sex, maturity, length, number, weight, gear type, # fishing, gender, vessel size, time fishing
Household surveys (2)	2005 (plus ~4 surveys over the past 20 years)	Spatial and temporal	Catch (recalled), gears, behaviour, consumption, income, effort
Professional fishing logbook (1)	Past 15 years	Spatial (?) and temporal	Species, weight, number, gear type, # fishing, gender, vessel size, time fishing, catch value, fuel consumption

Use of data

External project-based data collections were not used for assessment or management; however, the data collection activities led by the Wallis and Futuna government (Departments of Fisheries,

Environment or Statistics) are reported by the questionnaire respondents to be used to inform management. It is unclear how they are used and what management decisions result. Only the creel survey data are reported to be used in assessments using length-based spawning potential ratios (LB-SPR) and a length-based Bayesian biomass estimation method (LBB; Froese et al., 2018) (Table 43), however as surveys have only been running for one year it appears that assessments have not been conducted yet.

Table 43. Summary of metrics derived from data collections and their use to inform management.

Survey type	Metrics	Stock assessment	Management outcomes	Source
Underwater Visual Census (1)	Density (relative abundance), biomass, average size	No	No	Kronen et al., 2008b
Underwater Visual Census (1)	Density	No	Yes (how unknown)	Service territorial de l'environnement
Household surveys (1)	Catch composition, total production, fisher numbers	No	Yes (how unknown)	Service territorial de la statistique
Household surveys (1)	Fish consumption, catch (recalled), income from fishing, gears used, fishing behaviour	No	No	Kronen et al., 2008b
Creel Surveys (1)	Average size, size at maturity, SPR, catch composition, CPUE	Yes: LB-SPR and LBB	Yes (how unknown)	Service de la pêche
Fishing logbooks (1)	CPUE	No	Yes (how unknown)	Service de la pêche

Operational characteristics

Although there are some project-based data collections (Procfish), the long-term and more strategic data collection activities are locally led and implemented through the Fisheries, Environment or Statistics departments. This may be a function of external support as a French territory. It is also reported that Wallis and Futuna fisheries officers and fishermen have recently received training in the use of the fisheries data collection apps by SPC (TAILS and IKASAVEA) (https://www.spc.int/updates/news/2020/01/using-technology-to-improve-the-coastal-fishery-data-collection-in-wallis-and). These are likely to be the creel surveys reported by questionnaire respondents.

Key challenges

The key challenges for ongoing and consistent coastal fisheries data collection in Wallis and Futuna: ***multiple landing sites***, ***data inconsistency*** and ***changing survey design*** over time, ***limited time*** for surveys and ***fisher motivation***.

Key characteristics

- Long term national data collection activities are in place, but so far have not been used for assessment.
- Data have been reportedly used to inform management, but it is unclear how.

- Current time series data can potentially provide critical assessment outputs to inform management.

Summary of PICT data collection

Available data

Considering that only 13 of the 22 PICTs provided responses to the questionnaire about data collections, and for most PICTs these responses represented only a portion of historical data sets, the majority of information about Pacific data collections were derived from online literature searches. A summary of the known information about data collection activities across PICTs is provided in Table 45. The summary table focuses on attributes of data collection activities of the respective PICTs, grouped by the three main Pacific cultures (Polynesia, Melanesia and Micronesia), that helps to rapidly assess the relative potential for data sets in conducting stock status assessments. Determination of the capacity to conduct assessments using these data would require further examination, firstly by review of the accompanying PICT specific tables in the preceding sections, and the accompanying summary spreadsheet of data collections, followed by a closer examination of the data sources (e.g., report links in the spreadsheet). Finally, sourcing the raw data would provide the final means to assess the data utility.

Therefore, Table 45 below provides a summary for each PICT of i) the different types of surveys adopted in each, ii) an indication of the spatial and temporal coverage of the data (representativeness), and iii) the types of data available from these collections. An indication of the relative representativeness of the data is given by using a High, Medium and Low traffic light system broadly defined in Table 44.

Table 44. Guiding definitions for assigning high, medium or low for relative spatial and temporal coverage of the different data collections identified.

	Spatial coverage	**Temporal coverage**
High	>3 sites AND/OR good island/atoll coverage	Multiple (>6) years
Medium	>3 sites AND/OR moderate island/atoll coverage	3-6 years
Low	1-2 sites AND/OR 1-2 islands/atolls	1-2 year

Key observations about existing data

Key observations about data collection activities in the Pacific:

- It is highly variable and represents many different independent projects, mostly externally-led and -funded, and with differing goals and different approaches.
- Spatial replication is generally only moderate, with the best examples in smaller PICTs, which is to be expected, as they have a smaller area to cover.
- Temporal replication is poor overall, reflecting that the majority of data collection approaches are ‘snap shot’ and project-based. This likely reflects poor resourcing at the PICT level, and poor coordination and/or strategic project planning at the regional level.
- Data quality is not captured. However,
    - the vast majority of catch estimates come from the household surveys, which is recalled catch, and therefore subject to significant bias. Extrapolated catch is possible from some studies, particularly creel and market surveys. Either approach is likely to yield highly uncertain catch estimates;

- household surveys often have poor species resolution due to the bias in respondents' ability to recall catches; and
- fishing effort data are mostly available from household surveys, which are also estimated based on memory recall. More accurate estimates of total effort may be possible as extrapolations from creel surveys.

- Two SPC projects greatly influenced the amount of data for the region overall: Procfish (17 PICTs) and the Vulnerability of Coastal Fisheries to Climate Change project (6 PICTs). Further, largely due to the Procfish project, the majority of survey types documented are UVS (31 projects) and household surveys (24 projects). Although the goals of Procfish was stated as: "*…to provide baseline information on the status of reef fisheries, and to help fill the massive information gap that hinders the effective management of reef fisheries*", the survey approaches were not fishery-dependent or were subject to significant bias.
- Many PICTs have used their data for assessments of some species, but only using very simple and mostly length-based methods. In all cases these assessments were conducted by or with the support of external experts, and mostly were project-based.
- Very few assessments resulted in management outcomes. Many PICTs indicated the use of assessment methods, and management outcomes, but did not provide supporting details or management examples were not actual management controls, e.g., some were more about awareness raising. It appears that a strategic basis for data collection and assessment, to inform the development and implementation of management controls, is lacking in most PICTs.
- Examples of data collections that indicated a strategic and ongoing application of routine monitoring for assessment and management were extremely limited. A recent emerging example of a more strategic approach to data collection, is the Tuvalu creel survey program, run annually now since 2015, and with a key indicator identified along with a performance measure.
- Overall, projects in the Pacific that have included marine resource data collections, have had limited impact in contributing towards data that directly informs coastal marine resource stock status and are therefore limiting in their capacity to inform management decisions. It appears that a strategic basis to coastal resource management is lacking in the region. That is, data collection and any related assessment processes, appear to be lacking any clear and tangible management goals.

Historical use of data to inform stock status

An assessment of how existing available data have been used for assessments of stock and to inform management among the 22 PICTs, is given in Table 46. This assessment allows a rapid overview of the nature of assessments used among PICTs for coastal finfish fisheries, and although is likely to reflect the nature of the available data sets, it is likely to also provide an indication of the general technical capacity for assessments and of local monitoring and assessment frameworks. The table also summarises if data and/or assessment outputs have informed the implementation of management measures, further giving insight into coastal fisheries management systems in the region.

Table 45. Summary of coastal finfish data collection activities for Pacific Island countries and territories, identified from questionnaires sent to the respective PICTs and from online searches. This list is not exhaustive and is therefore indicative of data collection. Codes used in the table are: U – underwater visual census; C – creel survey; M – market survey; H – household survey; Biol. – biological sampling; Other; **green cells** – high; **orange cells** – medium; **red cells** – low; Ca. – catch; Lth – length; Wgt – weight; # - number; E – effort; B – local studies of biology of key species.

	COUNTRY/TERRITORY	SURVEY TYPE						SPATIAL	TEMPORAL	DATA TYPE					
		U	C	M	H	Biol.	Other			Ca.	Lth	Wgt	#	E	B
POLYNESIA	American Samoa			X		X			M		X	X	X	X	X
	Cook Islands	X			X			U, H		X	X		X		
	French Polynesia	X		X	X	X	X	U, H	M	X	X		X	X	
	Niue	X			X			U, H		X	X		X	X	
	Pitcairn Islands						X				X		X		
	Samoa	X		X	X			U, M	U, M	X	X	X	X	X	
	Tokelau														
	Tonga	X	X	X	X	X		U	U	X	X	X	X	X	X
	Tuvalu	X	X		X	X		C	C	X	X	X	X	X	X
	Wallis and Futuna	X	X		X		X	U	U, Oth.	X	X	X	X	X	
MELANESIA	Fiji	X	X	X	X	X		All	U	X	X	X	X	X	X
	New Caledonia	X		X	X	X	X	U, H. Oth	Other	X	X	X	X	X	X
	Papua New Guinea	X	X	X	X				U	X	X	X	X	X	
	Solomon Islands	X		X	X	X	X	U, H		X	X		X	X	X
	Vanuatu	X	X		X			U		X	X		X	X	
MICRONESIA	Guam	X	X	X				U, C	U, C	X	X	X	X	X	
	Kiribati	X	X		X	X	X	U, C, H	C	X	X	X	X	X	X
	Marshall Islands	X	X	X	X	X		U, H	U	X	X	X	X	X	X
	FSM	X	X	X	X	X		U, H, M	U, B	X	X	X	X	X	X
	Nauru	X	X		X	X		U, H, C?	B	X	X	X	X	X	X
	Northern Mariana Islands			X						X	X		X		
	Palau	X	X	X	X	X	X	U, H, M	M, Oth.	X	X	X	X	X	X

Table 46: Summary of how collected data have been used to assess stock status and to inform management decisions; Lth – length; Mat – maturity; CPUE – catch per unit effort. N.B. question marks indicate where some survey responses indicated an assessment or management outcomes but without any supporting details. For the 'Stock assessment' carried out column: **green cells** = yes, **red cells** = no.

	COUNTRY/TERRITORY	STOCK ASSESSMENT	ASSESSMENT METHOD	INFORMS MANAGEMENT IMPLEMENTATION
POLYNESIA	American Samoa			-
	Cook Islands			?
	French Polynesia			?
	Niue			-
	Pitcairn Islands	?		?
	Samoa	?	No details provided	Yes; size limits?
	Tokelau			-
	Tonga	Lth, Age	% catch < Lm; $F_{current}$ compared to F_{opt}	Yes; size limits?
	Tuvalu	Lth, Age	% catch < Lm; $F_{current}$ compared to F_{opt}	?
	Wallis and Futuna	Lth, Sex, Mat	LB-SPR and LBB	Yes; unknown
MELANESIA	Fiji	Lth, Sex, Mat	% catch < L_m; SPR	?
	New Caledonia	CPUE	CPUE trends compared to reference points	?
	Papua New Guinea	Lth, Age	$F_{current}$ compared to F_{opt}	?
	Solomon Islands	Lth, Sex, Mat	SPR	?
	Vanuatu	Lth, Age	% catch < Lm	Yes, see country section
MICRONESIA	Guam	Lth, Sex, Mat	SPR	?
	Kiribati	?		?
	Marshall Islands	Lth, Age	% catch < Lm; $F_{current}$ compared to F_{opt}	?
	FSM	Lth, Age	% catch < Lm; $F_{current}$ compared to F_{opt}	Yes, grouper management
	Nauru	?		Size limits?
	Northern Mariana Islands			-
	Palau	Lth, Age, Sex, Mat	ELEFAN (1991); % catch < Lm; $F_{current}$ *cf.* F_{opt}; SPR	Coastal finfish export ban

Capacity of regional data for future assessment of stock status

From the summary of available PICT coastal finfish data, and the limited historical application of these data for assessment and management, it is clear that data-limited assessment approaches are the predominant methods used in the region. The FAO stock monitoring tool (SMT) provides several data limited assessment options for assessing stocks for reporting against SDG14.4.1:

1 Catch-Maximum Sustainable Yield (C-MSY);

2 Electronic Length Frequency Analysis (ELEFAN); and

3 Yield-per-recruit/Spawning Biomass per recruit (YPR/SBPR).

The available evidence of the use of coastal finfish data in the Pacific also indicate the preference for simple length-based methods with the two most widely used being:

- Length-based Spawning Potential Ratio (SPR; Hordyk et al., 2015a, 2015b); and
- Length-based indicators particularly the percent of the catch < (or >) length at maturity (L_m) (Froese et al., 2004).

An assessment of the potential for existing available data to be used to apply the above data-limited assessment approaches among the 22 PICTs is given in Table 49. The assessment was based on how likely the available data could be used for each of the different methods, based on the data requirements for the respective methods (Table 47). The aim of this assessment was to identify the general data capacity in the region and which approaches may be best suited to PICTs. The likelihood of fulfilling the assessment method requirements was based on a simple relative assignation of high, medium and low using simple criteria (Table 48), and the criteria were assessed against the main data requirements of each method. This approach was used as a quick general guide since to comprehensively assess that each data set can be used for the respective methods would require obtaining each data set for more detailed assessment; a potentially time-consuming and challenging task for the 22 PICTs.

Table 47. Data requirements for selected data-limited assessment methods.

Assessment method	**Data requirements**
% catch < Lm	• Size frequency data • Length at maturity for assessed species[1]
Length-based Spawning Potential Ratio (LB-SPR)	• Size frequency data • Length at maturity for assessed species[1] • L_{inf}, M and life history ratios[1]
ELEFAN/ Yield-per-recruit (YPR)/ Spawning biomass-per-recruit (SBPR)	• Multiple samples of size frequency data within and/or across years, including date of capture, minimum 1 year preferred • Length at maturity[1] • Length-weight relationship[1] • Natural mortality (M)[1] • Growth parameter priors[1]
Catch-MSY (C-MSY)	• Catch data over at least 15 years • Estimates of resilience[1] • Estimation of start and end depletion ranges[1] • Natural mortality (M)[1]

[1]Some of the required data are available through other sources, either as empirical estimates or derived (e.g. life history ratios: https://biospherics.com.au/barefoot-ecologists-toolbox/). These data therefore do not necessarily need to be part of available collections.

Table 48. Relative criteria for the likelihood that key data requirements could be met for selected data-limited assessment methods.

	Criteria
High	Likely to fulfil requirements for at least some key species
Medium	May fulfil requirements for some species
Low	Highly unlikely to, or does not, fulfil requirements for any species

It is worth noting that there are other data-limited assessment approaches available that may be appropriate to regional data and technical capacity levels, but are not assessed here against available data (e.g., L_{opt} and L_{mega}; Froese et al., 2004). Rather, the current analysis has focused on currently promoted FAO data-limited methods, as well as the methods most commonly in the Pacific region under the assumption that previous use in the region is suggestive that the necessary technical capacity is present, or that at least there is some familiarity with the methods. The assumption of technical capacity would need to be tested on a PICT-specific basis for any further development and training in data-limited assessment methods, especially since the historical use of any assessment method in the region has included the use of external experts. Similarly, in a few past projects age-based indicators of fishing mortality have been estimated to assess stock status. Any age-based methods have not been included here on the basis that they are even more technical than size-based approaches (already used sparingly in the region), require higher levels of training and also require more expensive and technical equipment.

Key observations about the potential use of data-limited assessments

Key observations about the feasibility of using the selected data-limited assessment options based on existing PICT coastal finfish data:

- The C-MSY assessment method is likely to be possible for only a very small number of PICTs, with the major limiting factor being the requirement for at least a 15-year time series of catch data, covering a period in time where the fishery is evolving.
- YPR/SBPR methods were also only likely to be possible for a few PICTs due to the desirability for age and reproductive data.
- Length data are the most widely collected data, and therefore length-based methods of ELEFAN, SPR and other length-based indicators (such as the percentage of the catch < L_m), are likely to be possible for most PICTs. There is uncertainty in the availability of time series of length data for most PICTs that would support the use of ELEFAN.

Table 49. Assessment of the capacity for currently available data to fulfil the requirements of data-limited assessment methods promoted for SDG14.4.1 reporting. Two additional data-limited methods are also assessed as potential alternatives for PICTs. N.B. Confirmation of data suitability would require more detailed examination of individual data collection approaches, and ultimately the raw data. Supp. data = Supplementary data.

	COUNTRY/ TERRITORY	C-MSY			ELEFAN		YPR & SBPR				LB-SPR	% catch < L_m
		15 yr Catch time series	Life history	Supp. data	Length freq. data	Times series	Spawning stock wgt. by age	Selectivity by age	Prop. mature by age	M or F (optional)		
POLYNESIA	American Samoa											
	Cook Islands											
	French Polynesia											
	Niue											
	Pitcairn Islands											
	Samoa											
	Tokelau											
	Tonga											
	Tuvalu											
	Wallis and Futuna											
MELANESIA	Fiji											
	New Caledonia											
	Papua New Guinea											
	Solomon Islands											
	Vanuatu											
MICRONESIA	Guam											
	Kiribati											
	Marshall Islands											
	FSM											
	Nauru											
	Northern Mariana Islands											
	Palau											

4. Informing future data collections and reporting

Regional challenges

During the mapping exercise PICTs that completed the questionnaire were also asked to identify the key challenges to data collection efforts for coastal fisheries resources. The key recurring challenges identified by respondents were:

- Lack of funding.
- Lack of personnel.
- Limited expertise.
- Lack of equipment.
- Large distances and remote areas to monitor.
- Database issues.

These same issues are well founded and have been documented for the region over several decades, and reflect the available data in the region and their deficiencies. The constraints faced by PICTs are well articulated by the Palau Bureau of Marine Resources in their 2017 annual report, their first since 1992 as just one consequence of limited operational capacity (BMR, 2019). The report states that: "*Limited financial resources have obstructed the Bureau's ability to allocate much needed funding to core operations and, subsequently, have impacted the overall performance of the Bureau and its capacity*." These financial constraints have resulted in "*inadequate facilities*", "*a lack of expertise*", and "*limited operational capacity*". Some of the tangible consequences are "*…the largely outdated, piecemeal legal framework encompassing fisheries management which continues to hinder policy goals*." However, there are other intangible consequences such as "*…dwindling motivation and morale and low productivity from some staff members*." Notably, the report also states "*The Bureau has also struggled with fisheries data management, including data collection, storage, quality control and analysis, and would greatly benefit from additional technical expertise in this area*." (BMR, 2019).

As stated at the roundtable meeting (held 19 August, 2021) of regional experts as part of this mapping exercise, the above constraints represent the normal operating conditions among PICTs, and therefore give the context for any future support and development in monitoring and assessment approaches. That is, approaches need to be tailored specifically to these conditions and not just adopting what is done elsewhere.

Key data mapping observations (includes roundtable meeting outcomes)

Several generalised observations about Pacific coastal marine resource data collection, and their use, are notable:

- There is very little apparent **strategic approach** to data collection and how these data are used.
- The preponderance of **short-term project-based data** collections resulting in poor replicability of data methods and **poor temporal** replication.

- The most commonly used survey types are **fisheries-independent** and/or heavily biased (household surveys) thereby providing data that only indirectly inform coastal fisheries, at best.
- Assessment methods used by PICTs are predominantly **simple and length-based**. They have also historically required **external expert** guidance.
- Overall, there has been **limited use of data** for assessment and to inform management among PICTs.
- Often, even reliable **basic data** is **lacking**. For example, although the majority of PICTs have catch composition data available, the accuracy and relevance to coastal fisheries is dubious for many of them.
- Based on current data collections only **very simple assessment** approaches are likely to be possible for almost all PICTs (e.g., % catch < L_m).
- PICTs would benefit from having a **routine** data collection process designed to **inform management**.
- Any support for PICT coastal fisheries management needs to be framed upon **local needs** that aligns with **local capacity.**
- **Creel & market surveys** represent preferred data collection methods as they are cheap, simple and yield useful data.
- **Size (length) data** is the simplest type of data and represents the preferred baseline data for collections and assessments for most species in the Pacific.
- **SPC tools** under development have the potential to transform PICT coastal fisheries data collection approaches – standardized approaches, Artificial Intelligence (AI) for fish ID, e-monitoring, online resources and training (e.g., fish identification), user-friendly and PICT-appropriate data collection apps, centralised databases, etc.
- A **harvest strategy framework** designed for PICTs is needed, with tailored solutions and education - not adopted from other, larger countries.

Key gaps in Pacific coastal fisheries management

There are two key components that would facilitate improved reporting of SDG14.4.1 for the region in a sustainable manner:
1. A functional and appropriate coastal resource management framework, and
2. An effective internal reporting system.

A regional harvest strategy framework

Based on currently available data, and the lack of the use of data for assessment and management among PICTs, the capacity for reporting SDG 14.4.1 is likely to be very low. This is reflected in past statistical reporting rates for PICTs. Based on outcomes of the mapping exercise, as well as regional expert feedback and experience, there is an apparent lack of the application of a clear management framework for coastal fisheries in the Pacific region. That is, a framework that guides and links the collection of data, the use of assessment tools, and the application of

appropriate management measures. This is despite the existence of overarching regional policy documents, in particular *The Noumea Strategy* (SPC, 2015), but also other sub-regional policies such as the *Melanesian Spearhead group Roadmap for inshore fisheries* (Melanesian Spearhead Group Secretariat, 2015). These policies advocate for community-based approaches yet still require national top-down implementation processes that as yet lacks a clear strategic framework to guide departmental staff activities. This is reflected by slow progress in meeting policy goals, notwithstanding recent efforts (e.g., Pacific Community, 2021).

The disconnect is well articulated by Gillett et al. (2014) in a review of Fiji's coastal fisheries, who stated: "*Currently there is no lack of high-level directives to focus urgent action on improving the management of coastal fisheries. There is however no clear national policy or plan which lays out a clear pathway to implement these high-level directives at different levels or re-focus the work of the Department*." The result for the region, in effect, is many disparate data collection efforts, often by external actors and almost always with goals not well aligned to local priorities, that contribute piecemeal information about local marine ecological systems but without being part of any strategic local decision-making process. Further, these projects have a tendency to be implemented by external experts who introduce concepts and solutions that are westernised and technical in nature, thereby not customised to local conditions, systems or capacity. Although some of these projects may provide useful baseline data, the overall result is that they generally have no positive outcomes that enhance the sustainability of coastal marine fisheries.

For reporting SDG 14.4.1 to be possible, first PICTs need a clear fisheries management framework developed and implemented that facilitates standardised and routine activities that are customised to the specific local context (financial and technical capacity, geography, etc.) (e.g., Hordyk et al., 2015c). That is, an appropriate system that guides the collection of relevant data to facilitate an assessment of the condition of key stocks, and in turn their management. Being tailored to the local context is the only way to maximise the likely sustainability of management, and therefore, reporting systems. This will require external support in a coordinated, strategic, and inclusive approach to the development, education and implementation in the management system that includes guidance in the choices of very simple approaches. The resources and tools that are currently under development by SPC represent a potentially significant advancement towards achieving sustainable coastal fisheries management systems in the Pacific that are appropriate to local contexts, but represent only a portion of a full management system. For these resources to have a meaningful and sustainable impact they must be part of a simple, coherent, holistic and structured framework that has local and regional support.

The adoption and implementation of a Pacific regional harvest strategy framework for coastal marine resources will have multiple benefits:

- Through the identification of clear goals and outcomes linked to improving management and resource condition, it will provide purpose and focus to local and regional data collection efforts;
- A clear and simple framework adapted to local capacities will create cost- and time-efficiencies thereby enhancing the sustainable application of management-related processes;

- With local adoption it will provide significant leverage to align external actors and donor funded projects in providing meaningful and positive outcomes;
- A consistent regional approach to coastal resource management provides a greater platform for inter-regional knowledge sharing and learning;
- A well-designed framework can better optimise the use of relevant and appropriate available tools and resources that support the framework.

Reporting structures

For effective and sustainable statistical reporting by PICTs to external parties such as FAO and SDG 14.4.1 reporting, appropriate local reporting structures need to be in place. During the mapping exercise consultations, it became apparent that the identification of PICT-specific focal points or alternative focal points was a major challenge. This was due to two main factors: i. Many focal points or their contact details were no longer current, and/or ii. Response rates from focal points during consultations were low. These factors in turn made it very difficult to firstly identify or confirm focal points, and to ascertain local internal operational procedures for the maintenance of focal points and their roles, and communications with other focal points and relevant activities that support reporting. This scenario likely reflects the inherent local constraints experienced by each PICT (see *Regional challenges* above), and potentially that focal points are not fully aware of their role and/or that relevant local administrative structures are not in place. This is not surprising given the apparent challenges in developing and maintaining internal systems, let alone those related to engaging externally.

It is also likely that the roles and responsibilities of focal points, along with reporting responsibilities required by current questionnaires, need to be reviewed and adapted to the local context similarly to data collection and assessment. During the regional FAO workshops, it was reported that the average number of days required for completing the SDG14.4.1 questionnaire was 9.5 involving 3-4 people. This suggests that SDG14.4.1 reporting based on current requirements would be a significant challenge to PICTs, given the regional capacity limitations.

5. Supporting regional information

Under the consultancy, relevant information about coastal species that inform the process for assessment and FAO reporting were collated. This included the development of a preliminary reference list of stocks for each PICT, developed using readily available data. It should be noted that, although the term ‘fish’ is applied to be inclusive of finfish and invertebrates in the FAO SDG reporting process and terminology, fish was interpreted during this task as only relating to finfish. Therefore, the preliminary lists of stocks only include coastal finfish species, except in a few cases where individual PICTs began the process of including invertebrates. One of the required steps in developing reference lists of stocks is for relevant stakeholder consultation. This was done during the SDG14.4.1 workshop series with participating PICTs, for which each PICT was asked for their input to the preliminary finfish lists, and for the inclusion of key invertebrate species. The progress made to each of these preliminary lists has been highly variable depending firstly on the participation at the SDG workshops, and secondly the responses to email consultations and guidance on the lists. Although, the preliminary lists provide the basis for species and stocks to be assessed and reported for SDG 14.4.1, further PICT-specific review, input and approval is required for lists to become final versions. Each PICT have been provided the preliminary list for review

and the version provided in the google drive link in each PICT's profile page documents the lists derived during this current consultancy.

Further supporting information that were collated are key life history parameters for the most common species identified in the reference list of stocks for the whole region. These life history data represent critical input parameters for most assessment methods, even the data-limited approaches likely to be applicable in the Pacific, and was a specific request by SPC as a starting point to over time build a comprehensive database of life history data for key coastal species in the region. Ultimately, it is desirable and appropriate that this database is housed and maintained by SPC, with the associated support for each PICT in accessing and using these data. Therefore, the provision of these supporting information will further facilitate the capacity for PICTs to conduct assessments and for better SDG 14.4.1 reporting.

These resources, particularly the life history dataset, are intended to act as ongoing resources for PICTs to facilitate and promote the use of applicable assessment approaches used more routinely as the proposed harvest strategy framework implementation is adopted across the region. Given the supporting role of SPC, and their ongoing and current investment in the development of resources and tools applicable to the harvest strategy framework, it is recommended that their coastal fisheries division incorporate the life history database as part of these ongoing efforts. This database can be maintained and improved by SPC as part of the resources made accessible for use by PICTs moving forward.

Key species and stocks

Identification of species

Identification of a reference list of key stocks followed a structured process using available published data obtained during the consultation and online searching phase, and following the FAO criteria. These criteria include:

1. The data from which species are selected should be representative of fish stocks exploited using data from the country's data;
2. Should represent at least 60% of current national landed/reported catch;
3. Should contain major stocks (representative of catch, ecosystem role, economic value, social/cultural importance);
4. Local stakeholders should be consulted in developing the list.

In addressing the first 3 criteria, three categories were used to identify a preliminary list of stocks based on the source of data used:

Category 1: Using fisheries-dependent sampling method data (creel or market surveys) to establish the species making up the top ~70% of the catch. This is considered the most representative and therefore accurate data source.

Category 2: Using sampling dedicated for biological analyses (reported in the respective project reports to be on key local target species), and includes the species making up the top ~70% of the catch.

Category 3:[3] Based on household surveys which is estimated (recalled) catch only, and includes species making up ~60% of the catch. Household surveys are considered to have high uncertainty and to be the least reliable.

Also following the FAO criteria of key stocks, the stock unit for assessment was identified based on the criteria in Table 50. As far as could be established, there are no 'official' (i.e., used as part of a routine management processes) stock assessments used for any finfish stocks in the 22 PICTs. It is also unclear if the management unit has been defined by the relevant management agency. As such, for each stock the reporting level is assumed as being at the species and area level.

It is worth noting that the geography of many PICTs complicates the use of the current FAO definitions of stocks under assessment. For example, many PICTs are comprised of small island chains or groups, some separated by 10's of kilometres, while others are separated by 100s-1000s of kilometres. This has the potential for a single species in one PICT to be determined as having many separate stocks for reporting purposes, and therefore may only serve to overwhelm resource limited PICTs and prevent accurate and sustainable reporting. Further, stock structure research on coastal species in the Pacific is extremely limited. Therefore, currently the determination of stock units in the Pacific needs several assumptions about rates of species dispersal at the different life history stages. It is therefore **recommended** that guidance should be developed for the Pacific region that is specific to the regional context and considers:

- the spatial geography and extent of PICTs; and
- the potential for an individual species to have many different stocks for reporting.

Table 50. Criteria used by FAO for identifying the reporting level for the stock under assessment.

Is an official stock assessment available?	Has the management unit been defined?	Reporting level
YES		Assessment unit level using stock assessment outputs
NO	**YES**	Management unit level, if defined by management agency
NO	**NO**	Report at species and area level

Preliminary reference list of stocks

The preliminary reference list of stocks for each PICT is provided as separate spreadsheets (see gdrive links in each PICT profile page) with the following data fields: Family, Species, Country or Territory, the species ranking according to their percentage composition in the catch (where provided), the Pacific cultural region (Melanesia, Micronesia or Polynesia), the category (above) for identifying stocks, and the reporting level (Table 50). It is not possible to detect any patterns or obvious groupings of species at this stage, noting that the list is still subject to stakeholder input from the respective PICTs. Based only on the data sources considered the most reliable (Category 1 & 2), the most common species across PICTs were: *Lutjanus gibbus* (13 PICTs), *Naso unicornis* (13), *Hipposcarus longiceps* (9), *Acanthurus lineatus* (8) and *Naso lituratus* (7). The most common families (Category 1 & 2) were: Acanthuridae (42 occurrences, 13 species, 20 PICTs), Lethrinidae (28, 14, 10), Scaridae (25, 9, 13), and Lutjanidae (25, 8, 14).

[3] The only available data to derive a local reference list of stocks for the Pitcairn Islands was Baited Remote Underwater Video data. It was placed in Category 3 data (least reliable) as it was fisheries-independent.

Key observations on identifying key species

Some key observations regarding the data available to identify the reference list of stocks are:

- The reliability of catch composition data is uncertain or generally low due to several reasons including:
    - The common use of household surveys for collecting fisheries data, including recalled catch by species.
    - The reporting to genus or family level in many data sets (e.g., Nauru, New Caledonia, Tonga and Vanuatu).
    - Uncertainty in the representativeness (spatial coverage and temporal relevance) of the data.
- Few records exist earlier than 2000; however, where available these data may identify key stocks that have been locally depleted and may warrant inclusion. The current lists are therefore primarily based on (relatively) contemporary catch composition data.
- Two notable species that tend be appear more in the few early records are *Bolbometopon muricatum* and *Cheilinus undulatus*. Since they are both considered as high value and highly sought-after species, it is likely that both have experienced overharvesting as a key reason for not being more prevalent in contemporary catch data. Both are ecologically important and/or culturally important regionally.
- Catch composition data were unable to be located for Northern Mariana Islands and Tokelau.

Following the FAO criteria for selecting the reference list of stocks, consultations with relevant stakeholders on the preliminary list of species is still required in all PICTs to finalise these lists. This should be done in conjunction with further consultations with identified focal points.

Key species life history

Given the preliminary nature of the reference list of stocks established for each PICT, life history data was gathered only for the most common species across all PICTs with the criteria that they must be a key species in at least three PICTs. This resulted in a list of 20 species (Table 51) that provides a significant foundation for a database that can be built on and informed by the reference list of stocks once finalised by each PICT, to ensure that all key species for the region are included. The life history characteristics included in the database were: morphometrics, growth, mortality, longevity, and reproduction. The preliminary life history data are accessible through the gdrive at: https://docs.google.com/spreadsheets/d/1wg4F3hRJy2AVdakUmdvMSxPaaDAlVWJk/edit#gid=1821373934.

Table 51. Initial list of species included in the life history database.

Family	Species	# of PICTs
Lutjanidae	*Lutjanus gibbus*	13
Acanthuridae	*Naso unicornis*	13
Scaridae	*Hipposcarus longiceps*	9
Acanthuridae	*Acanthurus lineatus*	8
Acanthuridae	*Naso lituratus*	7
Scaridae	*Chlorurus microrhinos*	5
Holocentridae	*Myripristis berndti*	5
Carangidae	*Caranx melampygus*	4
Serranidae	*Epinephelus merra*	4
Lethrinidae	*Lethrinus olivaceous*	4
Lutjanidae	*Lutjanus fulvus*	4
Siganidae	*Siganus argenteus*	4
Acanthuridae	*Acanthurus xanthopterus*	3
Carangidae	*Caranx sexfasciatus*	3
Serranidae	*Epinephelus polyphekadion*	3
Lethrinidae	*Lethrinus obsoletus*	3
Lethrinidae	*Lethrinus rubrioperculatus*	3
Lethrinidae	*Lethrinus xanthochilus*	3
Mullidae	*Parupeneus barberinus*	3
Scaridae	*Scarus rubroviolaceus*	3

6. Recommendations

The following key recommendations are based on the outcomes of the current data mapping exercise and take into account local expert feedback (roundtable meeting), regional consultations and the FAO SDG14.4.1 training workshop series held in the Pacific during this consultancy. These recommendations provide guidance to future FAO Pacific support to PICTs, that should be in partnership with key regional organisations including SPC and SPREP. Further, the recommendations represent a package of actions that are linked to one another, meaning that their success will be optimised if implemented collectively.

- Central to this package of recommendations is the **development** of a **regional management framework** that will facilitate and guide a strategic and consistent approach to coastal resource management. A critical element that appears to be lacking for the entire region is basic guidance for coastal fisheries management systems that puts into context the relevant key processes: data collection activities, resource assessment and management actions. Such a harvest strategy approach is adopted globally in fisheries as best practice, and aligns with and helps to achieve key elements of the overarching regional policy for coastal fisheries – *The Noumea Strategy*. Harvest strategy frameworks are *outcome-focused* with clear objectives that links monitoring (data collection) with assessment, and links assessment with management. The framework should be prescriptive to the point that it only includes elements that are commensurate with regional capacity, but still comprehensive enough that it allows individual PICTs choices that meets their local needs and are within their local capacities. Such a framework,

adopted at the regional level, would provide a clear strategic basis for activities and methods that, if appropriately customised for each PICT, would maximise the likelihood for management that provides sustainable fisheries and sustainability of the processes that support the framework. Development of such a framework that is commensurate with the regional limitations in capacity and resourcing is key. While the journey required to achieve successful implementation of such a framework may be lengthy and challenging, the potential benefits to the region and to individual PICTs is immeasurable.

  - **PICT-appropriate data collections** – guided by a regional harvest strategy framework, a locally appropriate system of data collection, and data collection strategy/ies, can be established that is feasible for the geography, resourcing, and technical capacity. Given the well acknowledged constraints in the region, robust fisheries-dependent approaches are recommended as data collection methods that are simple, cost-effective and provide relevant data (e.g., creel and/or market surveys). The goal should be for data collections that are routine, that collect key species length data as a minimum, and are directly linked to assessment methods that align with local capacities.
  - **Locally appropriate assessment methods** – a regional framework should identify and provide guidance for choices of assessment methods that best suit regional data collection capacity and available technical capacity for applying and interpreting methods. A tiered approach is one possible approach that provides flexibility to cater to different levels of capacity, and guides users to increasingly complex assessment methods based on available data and capacity, both in the capacity to collect data and the technical capacity to conduct assessments. The first entry point for such a system would include simple, length-based methods that require limited data and have already been applied in the region.
  - **Management tool guidance** – to further support the framework, simple guidance should be provided of management measure options that are linked to assessment outcomes.
  - **Framework development** – the development of a regional harvest strategy framework, and conducting the processes necessary for successful adoption and implementation, will involve a lengthy and challenging process. Several steps are required to achieve this, including: i) a comprehensive scoping study to develop a draft conceptual framework that articulates relevant details and identifies linkages to regional policy goals and to existing tools, resources and programs, ii) regional support through engagement, including education, with PICTs and regional agencies, iii) full development of a framework that details all elements (e.g., alignment with regional programs, regional partner support, foreign donor support, political will, capacity building needs, education and awareness), and strategies for their success, iv) an appropriate plan for implementation linked to the SPC coastal fisheries programme activities.

- **Regional partnership development** – significant research and development work in much of the Pacific, including fisheries data collection and resource assessment, has historically

been delivered under projects driven by various regional non-government agencies and organisations (NGO's) with a presence in the region. These projects are generally in partnership with relevant PICT government departments. Therefore, these NGOs represent a significant regional resource capable of providing a valuable contribution (expertise, people, time and money) towards supporting PICTs in achieving common goals identified under a consistent framework. Optimising the buy-in and contribution of this regional capacity will require that NGOs are part of the harvest strategy framework development; this will better foster widespread regional understanding and support for the framework and its adoption. SPC represents a significant partner organisation to all PICTs and the development of the framework should be at least co-driven by them, especially given their role of supporting individual PICTs at the local level.

- **Staying the course**! – with the adoption of a local management system, guided by the regional framework, PICTs will be in a stronger position to ensure proposed donor projects help to meet local priority needs by aligning with their overall country strategy. The Pacific receives many external donor-funded projects that bring significant financial incentives but with varying goals that are invariably broad and non-specific; examples include: enhancing resilience to climate change, improving food security and building local capacity. Past approaches have therefore tended to have poor outcomes (e.g., Westoby et al., 2019). The adoption of a clear internal system that guides fisheries research and development activities will provide leverage for large projects to *actually* make a contribution to local resilience, and bring positive benefits. This will require transparency in processes and political will at the local level.

- **Aligning and integrating with current efforts** – tools and resources currently under development by SPC (https://www.spc.int/CoastalFisheries) have the potential to greatly enhance the capacity for PICTs to implement coastal fisheries data collection strategies. Although still under development, they currently don't provide guidance on the critical links between monitoring, assessment and management that an overarching framework would, and are focused predominantly on the data collection aspects of a management system. For these tools and resources to have a meaningful and sustainable impact in the Pacific they will need to first be clearly aligned with, and within the context of, the regional management framework. This will be critical to the future success of these collective initiatives.

- **Targeted capacity building** – the successful development and adoption of the framework and its components, as well as incorporating the above recommendations, will require a range of well-crafted and locally appropriate education, awareness and training initiatives.

- **Internal reporting mechanisms** – the adoption of the proposed harvest strategy framework has the potential to significantly improve reporting of SDG 14.4.1 by PICTs. However, improved reporting is also likely to require some level of support to PICTs including: review of current questionnaires reporting requirements to ensure they are commensurate with local capacity; and concise but clear guidance on focal point roles and responsibilities. High level guidance is currently provided by FAO, however, in the

resource-poor Pacific region further detailed and customised support is likely to be necessary to facilitate improved and ongoing reporting.

7. Resources

Other potentially useful resources to guide and support monitoring, assessment and management systems for data-limited regions such as the Pacific include:

FishPath tool

The FishPath Tool is an online decision-support tool for data-limited fisheries management. The primary goal of the FishPath Tool is to support users in understanding and refining options for the three major components of a harvest strategy: 1) data collection, 2) data-limited assessment, and 3) management measures. Once registered, you may access the FishPath Tool, including the FishPath questionnaire, interactive results tailored to your fishery, and supporting resource. The tool is best applied with expert facilitation.

Website: https://tool.fishpath.org/Questionnaire

Barefoot Ecologists Toolbox

Two websites:

1. This uses recent developments in open-source software packages to provide a range of user-friendly interactive tools without having to understand the complex mathematical equations. The focus is on the application of the Length-Based Spawning Potential Ratio (LB-SPR) method, becoming more commonly applied as a data-limited assessment method in the Pacific, and in providing empirical estimates of natural mortality (M). The portable toolbox allows users to use the applications in locations or conditions where the Internet is not available.

2. This website includes a vast range of downloadable tools and resources: i) education and guidance in the use of the LB-SPR assessment method, ii) analytical tools to support the use of the the LB-SPR method (e.g., key assessment input parameters and their derivation, templates for data collection and analysis), and iii) educational tools that support sustainable fisheries concepts.

Website #1: http://barefootecologist.com.au

Website #2: https://biospherics.com.au/barefoot-ecologists-toolbox/

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