Pacific Community
Communauté du Pacifique

Monitoring of community-based fisheries management:

A guide for the Pacific Islands



Monitoring of community-based fisheries management:

A guide for the Pacific Islands

Caroline Vieux, Hannah Gilchrist,
Teri Tuxson and Hugh Govan

Pacific Community
Communauté du Pacifique

2026, Nouméa, New Caledonia

© Pacific Community (SPC) 2026

All rights for commercial/for profit reproduction or translation, in any form, reserved. SPC authorises the partial reproduction or translation of this material for scientific, educational or research purposes, provided that SPC and the source document are properly acknowledged. Permission to reproduce the document and/or translate in whole, in any form, whether for commercial/for profit or non-profit purposes, must be requested in writing. Original SPC artwork may not be altered or separately published without permission.

Original text: English

Cover image : A traditional fishing vessel. Photo: Joseph Hing © SPC.
For any requests to re-use photographs, please write to publications@spc.int
Layout: Constance Odiardo (SPC)

Contents

Abbreviations 1
Acknowledgements 2
Glossary 2
Introduction 3
- Purpose of this guide 4
- How to use this guide 4

Key considerations 5
- Purpose of monitoring 5
- Resource and capacity constraints 5
- Scale: community or programme monitoring 6
- A tiered monitoring approach for CBFM 8

Monitoring design 9
- What will be measured? 9
- When will indicators be measured? 11
- Where will the indicators be measured? 12
- Controls and baselines 12
- How will the indicators be measured? 13

Monitoring methods 9

Monitoring fish and invertebrates in their environment 15
- Method sheet 1 Focus group discussion (in-water status) 18
- Method sheet 2 Basic belt transects 16
- Method sheet 3 Interviews (in-water status) 21
- Method sheet 4 Advanced belt transects 23

Monitoring catches 15
- Method sheet 5 Focus group discussion (catches) 28
- Method sheet 6 Basic catches surveys 31
- Method sheet 7 Fisher logbooks 34
- Method sheet 8 Interviews (catches) 36
- Method sheet 9 Advanced catch surveys 38

Monitoring habitats 41
- Method sheet 10 Habitat observation 42
- Method sheet 11 Point intercept transects 45
- Method sheet 12 Quadrats 48

Monitoring socio-economic change 51
- Method sheet 13 Focus group discussion (socio-economic) 52
- Method sheet 14 Interviews (socio-economics) 54
- Method sheet 15 Interviews (household surveys) 56

Using data for fisheries management 58
- Interpreting monitoring results 58
- Case studies of data use in CBFM 61
- Data communications and sharing 65
- Produce your information tools to share your results 66

Additional resources 67
References 68
Appendices 71

Acronyms

AIMS	Australian Institute for Marine Science
CBFM	Community-based fisheries management
CSO	civil society organisation
FLMMA	Fiji locally-managed marine area
FSM	Federated States of Micronesia
GCRMN	Global Coral Reef Monitoring Network
GPS	Global Positioning System
ID	identification
LMMA	locally-managed marine area
MS	Method sheet
NGO	non-governmental organisation
RMI	Republic of the Marshall Islands
RTMCFA	Regional Technical Meeting on Coastal Fisheries and Aquaculture
SMA	Special management area
SPC	Pacific Community
UOW	University of Wollongong
WWF	World Wildlife Fund
ZPR	*Zone de pêche règlementée* (regulated fishing zone)

Acknowledgements

The Pacific Community would like to thank the European Union and the Government of Sweden through the Pacific-EU Marine Partnership programme, in addition to New Zealand's Ministry for Foreign Affairs and Trade, for the financial support to develop this guide.
In addition, the authors would like to thank the following people for their time and thoughtful contributions throughout the drafting and review process: Sandrine Job, Johanna Johnson, Dave Welch, Dirk Steenbergen, Watisoni Lalavanua, Ivory Masiala Akao and Céline Muron. We also would like to express our gratitude to all those who are cited in the text as generously sharing information through personal communications.

The ideas and opinions expressed herein are those of the authors alone and do not necessarily reflect the views of the European Union, the Government of Sweden, or the Government of New Zealand.

Glossary

Community-based fisheries management: Community-based fisheries management (CBFM) is understood as fisheries management approaches that are community-driven and encompass an ecosystem approach that will sustain livelihoods and ensure resilient island communities.

Community: The word community is normally understood as a village or settlement. In this guide, however, the unit used for "community" depends on national CBFM definitions, which in practice may mean districts, states, communes, island councils or municipalities, depending on the country or territory.

Periodically harvested closure: A specific area is closed to fishing for a certain period to allow fish populations to recover and reproduce. After the closure period, the area is reopened for fishing during a specified harvest period. This cycle of closure and reopening is repeated periodically.

Underwater visual census: This is a method used to assess and monitor fish populations and other marine organisms in their natural habitats. This technique involves divers or remote underwater cameras visually counting and recording the species and numbers of marine life within a defined area.

Programme monitoring: Programme monitoring is led by governmental or non-governmental organisations implementing CBFM programmes at island, provincial or national levels. Their objective is to ascertain if their programmes are meeting their objectives, such as improving resource health or community livelihoods.

Community monitoring: Community monitoring is led by communities themselves to assess the effectiveness of their local management rules. The methods used tend to be simple and the information collected focuses on species and habitats of interest to a particular community.

***Ra'ui*:** This is a traditional resource management practice, usually a temporary closure, during which access to a terrestrial or marine area is restricted or prohibited to allow ecosystems and species (fish, crustaceans, plants, etc.) to regenerate.

Focus group: A small, diverse group of community fishers (e.g. male, female, youth, experienced fishers, elder fishers) is brought together to discuss their experiences, opinions and knowledge about the status of their fisheries and what they observe as impacts of management.

Point intercept transect: This is an in-water survey technique, where a tape measure (transect line) is laid across the reef, and the substrates or organisms directly beneath fixed points along the line are recorded. This approach provides a quick, quantitative snapshot of benthic cover (e.g. coral, algae, sand) and helps track changes in reef composition over time.

Belt transect: This is an in-water survey technique that involves stretching a tape measure (transect line) along the substrate and recording all organisms or substrate types within a fixed distance on either side of the tape like a 'belt'.

Introduction

Pacific cultures and ways of life are deeply intertwined with the sea, so coastal communities play a critical role in the management and conservation of coastal resources in the Pacific region (Johannes 1978). The important role of community action in marine resource management is recognised in regional coastal fisheries policies (King et al. 2003; Govan et al. 2024: 20) including more recently the Noumea Strategy, and the Pacific Framework for Action on Scaling up Community-based Fisheries Management 2021–2030 (SPC 2021a).

Community-based fisheries management (CBFM) is the management of coastal fisheries and ecosystems by communities to sustain livelihoods and improve resilience to threats (Govan et al. 2024). The last few decades have seen a rise in the number of Pacific nations with CBFM programmes dedicated to supporting communities in managing their own fisheries resources. However, in 2022, only 10% of an estimated 10,000 communities across the region were involved in some form of CBFM (Govan and Lalavanua 2022). Challenges encountered in scaling up CBFM include the sheer number of communities requiring support, their remote nature, and the diversity of cultures and fisheries to be considered. The Pacific Framework for Action on Scaling up Community-Based Fisheries Management 2021–2030 outlines a roadmap for scaling-up CBFM, despite these challenges.

For CBFM to be effective, there should be some mechanism or system that collects information to evaluate management and adapt or improve it so that it achieves desired objectives. This system is referred to as an adaptive management cycle (Table 1).

Table 1. Steps needed to conduct community-based fisheries management

STEPS IN CBFM	DETAILS
1 Identify issues **Community discusses and identifies a problem.**  https://cbfm.spc.int/raise-your-issues	If communities realise that they have a problem with their available marine resources, this will be a first step towards agreeing on possible actions to manage it. If it is evident to most of the community, there is a higher chance that there will be support for action. Information and awareness may help stimulate discussion on the state of fisheries resources.
2 Make rules **Community agrees on actions needed for managing the problem. Actions can be simple rules or a management plan.**  https://cbfm.spc.int/make-rules	Communities identify specific resources or species that are under threat and explore the best possible solutions or actions to solve that problem. Appropriate actions will depend on the species, so it is important to be clear about the threat and the species of concern. E.g. "We depend particularly on rabbitfish and now they are much smaller or rarer than before," rather than, "Smaller fish catches". The community will try to set rules that are most likely to address the threats in their context. Traditional knowledge and/or best available scientific information can be used. https://cbfm.spc.int/which-marine-resource
3 Take action **Community enforces rules, implements agreed actions or management plan.**  https://cbfm.spc.int/take-action	The community agrees to implement actions and abide by the rules. The consensus achieved and understanding of the ecological basis of the rules should increase compliance. Implementation and compliance with the rules will soon be apparent but whether these are having the desired positive effect on resources may take longer and be harder to perceive; this is where CBFM monitoring comes in.
4 Assess (or re-assess) **Community checks whether the rules or plan are working. This guide helps you choose monitoring methods to use.**  https://cbfm.spc.int/evaluez-lefficacite-des-regles	Monitoring falls under this stage of the adaptive management process. Monitoring should test whether fisheries management rules are having their intended effect. The findings will help decide whether the rules or management plan should continue or whether they need to be discussed and improved, in which case the process goes back to step 1 above.

This guide focuses on Step 4 of this management cycle – how to assess, or re-assess, fisheries to ensure that they are sustainably managed, and meeting future livelihood and food security needs.

It is worth noting that CBFM does not usually intend to maximise fisheries production. Instead, communities typically implement CBFM to achieve locally identified objectives, which often include maintaining or improving fisheries resources, food security, livelihoods, ecosystem health, cultural values and resource availability for current and future users (Govan et al. 2009; Jupiter et al. 2014).

One key challenge in assessing fisheries is ensuring that monitoring approaches suit the financial and technical constraints associated with CBFM contexts (Govan et al. 2011). There are many examples of monitoring approaches taken to inform CBFM efforts across the Pacific region, but only some of these are adapted for use by communities themselves, without extensive funding or technical support (SPC 2019, 2021b, 2022). There is a clear need to understand what monitoring approaches are being used in the Pacific region and learn from them to guide governments and CBFM practitioners in selecting monitoring methods that suit the technical and financial capacity available.

Purpose of this guide

This guide collates tested monitoring methods used to assess CBFM effectiveness in the Pacific region to assist practitioners in implementing appropriate CBFM monitoring – whether for national level programmes, or community-level fisheries.

Although many methods may be used to assess fisheries management effectiveness, the focus here is on those known to have been used in CBFM contexts in the Pacific region. Information about each method, is presented, including a rating of cost, technical capacity required and resulting data quality, as well as the intended objectives of the monitoring method and protocols. This guide also suggests ways to analyse and use results of monitoring to inform management.

How to use this guide

This document outlines step-by-step how to choose appropriate monitoring methods in various CBFM contexts, based on existing work and experiences in the Pacific region. Guidance first covers how to select monitoring methods and key considerations when designing a monitoring programme. It then presents methods alongside protocols, equipment requirements and case studies, where the approach has been used before. Table 4 on page 13 gives an overview of methods and on which pages these can be found. The last section of this guide touches on ways that data can be interpreted, used and communicated.

Key considerations

Purpose of monitoring

The foundation of any monitoring programme rests on the clarity of the end-uses of the data. This guide primarily presents methods used to assess the effectiveness of CBFM.

Other purposes for monitoring may include:

- the detection of emerging issues in marine resource status;
- an increase in stakeholder engagement and a sense of ownership of resources;
- development of stakeholder awareness or education in CBFM topics;
- provision of data required for national reporting; and
- enabling targeted research.

Monitoring may fulfil one or several objectives, but it is vital to define and agree on a primary purpose of the resulting data before proceeding with planning monitoring efforts.

Resource and capacity constraints

The physical isolation of many communities, and the potential need to work with hundreds, if not thousands, of communities to support evaluation of their CBFM efforts over the long term means that some important constraints and criteria should be considered before selecting monitoring methods. They include the following.

- **Cost:** The amount of time, money and human resources the monitoring might require, whether for equipment, travel or external data processing.
- **Capacity and complexity**: Will the method be carried out by community members with little training or guidance? Is regular training needed or even input from highly qualified staff or researchers?
- **Data accuracy and precision**: Simple or structured records of perceptions may be enough to detect how species of interest are responding to management actions. Sometimes, however, more rigorous evidence using quantitative methods may be desired to fully trust results, or to use results in advocacy, programme evaluation or for scientific purposes.

These factors must be considered carefully when selecting a method to monitor a chosen objective to ensure the long-term sustainability of the monitoring programme. Choosing approaches that rely on specialised expertise or expensive equipment, compromises replicability and/or extensive uptake by communities. Monitoring the effects of CBFM in the region should be a cost-effective and long-term activity. While one-off funding can allow a more in-depth snapshot of ecosystem and socio-economic status, regular monitoring should be accessible to what fisheries departments can afford and what communities can do on their own with minimal or no external assistance.

Scale: community or programme monitoring

There are different scales across which monitoring may be carried out: at community level, or across programmatic, national, or even regional scale. Community monitoring aims to understand if local management efforts are effective at an individual community level, whereas "programme" monitoring aims to understand how effective a national or regional CBFM programme is across many communities. Key differences are outlined in Table 2 and expanded on below.

Table 2. Contrast between key features of community and programme monitoring

	Community monitoring	Programme monitoring
Objective(s) covered by this guide	Assess if local management rules are working and adapt if necessary Detect emerging issues	Assess if national CBFM or project programmes are meeting their objectives (e.g. improving resource health and community livelihoods)
Where?	Each community engaged in local resource management or concerned about coastal resources	National monitoring across multiple communities involved in CBFM
What?	Local fisheries health and livelihood indicators (e.g. measuring impacts from establishing a no-take zone or measuring the size of local species of interest)	Wider fisheries health and community livelihood indicators, species, habitat health or, inputs into CBFM programmes such as training, workshops and educational materials (CBFM "tracking")
How?	Methods that are simple and quick to conduct, with data that are easy to analyse: for example, questionnaires or surveys on perceptions of resource status, with collection of quantitative biological data where sufficient ongoing support can be guaranteed	Collection of biological and socioe-conomic data using advanced methods complemented by perception-based methods to expand the scale of the monitoring
By whom?	Largely or entirely by communities	Fisheries officers, research partners, NGOs
How much?	Mainly low cost with very little time investment required from communities	Within government budgets and human resources available

Community

Community monitoring should primarily address the objectives and information needs identified by the community.

The purpose of community monitoring is to enable communities to make informed decisions about fisheries management and address questions such as:

- Are local management actions working?
- Should we maintain or modify our rules or management approach?

Some sort of monitoring should be carried out **in all communities that have established local management measures,** although, as discussed later, such monitoring may encompass perceptions or anecdotal observation, or more quantitative monitoring of resource status. Whatever the approach, monitoring should help to see if management measures are having the intended effect on issues of concern, such as fish catches, and, if not, guide discussions on new or modified management actions.

This monitoring should be led by the community itself and rely on little or no external support to reduce the likelihood that external factors will limit regular monitoring. Ideally, all steps of community-based monitoring can be managed locally; from data/information collection through to data analysis, interpretation, reporting, and adaption of local management. This allows for rapid turn-around times and data feedback so that adaptive management can occur at a local scale in a dynamic way that reduces reliance on partners. Partners' constraints in terms of availability and funding for data collection, taking the data away for analysis and returning the results, all too often leads to local frustration or loss of the momentum for adaptive management.

Community members have many competing livelihood, family and cultural responsibilities. Monitoring approaches should therefore minimise unnecessary time demands and focus on information that communities can directly use to support management decisions. Information generated through community monitoring may also contribute to programme or national-level evaluation where these information needs overlap. But experience from CBFM programmes across the Pacific region suggests that monitoring is more likely to be sustained when communities see clear benefits of the effort they invest in information collection and can use it to support local decision-making.

The primary considerations of community monitoring efforts are that data are:

- easy to acquire;
- simple to understand;
- appropriate for measuring effectiveness of community fishing rules; and
- delivered in a timely manner for the community.

Programme 

CBFM monitoring at the scale of national programmes covers a wide range of species and socio-economic outcomes. Examples of these programmes are the Community-Based Fisheries Management Programme (CBFMP) in Samoa, Special Management Areas (SMAs) in Tonga, *Zones de Pêche's Réglementées* (ZPR) in French Polynesia, and the Community-based Resource Management programme (CBRM) in Solomon Islands.

At a programme level, monitoring objectives are determined by national agencies or NGOs, who may be carrying out a project with aims that go beyond the support that each community receives. The objectives of monitoring in this case may be to assess the effectiveness of CBFM programmes implemented at the scale of a province, country or region, in line with the framework for action on scaling up CBFM. This monitoring is implemented by the leads of such programmes, mainly ministries of fisheries, national/regional or even local NGOs.

Programme monitoring tends to be more costly and requires greater skills to collect and analyse data than community-level monitoring due to the geographic scale that data need to be collected across, and the number of indicators required to assess a programme's effectiveness. Assessing the change due to support from an organisation or programme is critical to understanding CBFM effectiveness at national or subnational levels to inform or adapt government policy and legislation. Monitoring results can also be used to justify the use of human resources and funds towards achieving CBFM outcomes.

Programme monitoring should take care not to place excessive data collection requirements on communities. Community monitoring is most likely to be sustained when communities see clear benefits from the information collected and can use it to support local decision-making. Additional monitoring required for programme evaluation, donor reporting or research may require separate investment in staff, training and resources rather than relying on community volunteers.

Key considerations for programme monitoring:

- widescale monitoring should be affordable within the constraints of sustainable long-term funding, e.g. government budgets;
- different monitoring methods may be used in different locations, depending on capacity available and community interests; and
- different communities may carry out monitoring at different scales or intensities.

Programme implementers may also need to carry out more intensive monitoring of specific issues or indicators at selected or representative sites to verify assumptions in their programme theory or conduct research on specific issues. It is important to coordinate with other stakeholders to ensure that monitoring efforts are as coordinated as possible, with little to no duplication of effort. The long-term sustainability of monitoring is likely to depend on communities perceiving clear benefits from participation. Monitoring systems that primarily address external reporting needs may be more difficult to sustain over time.

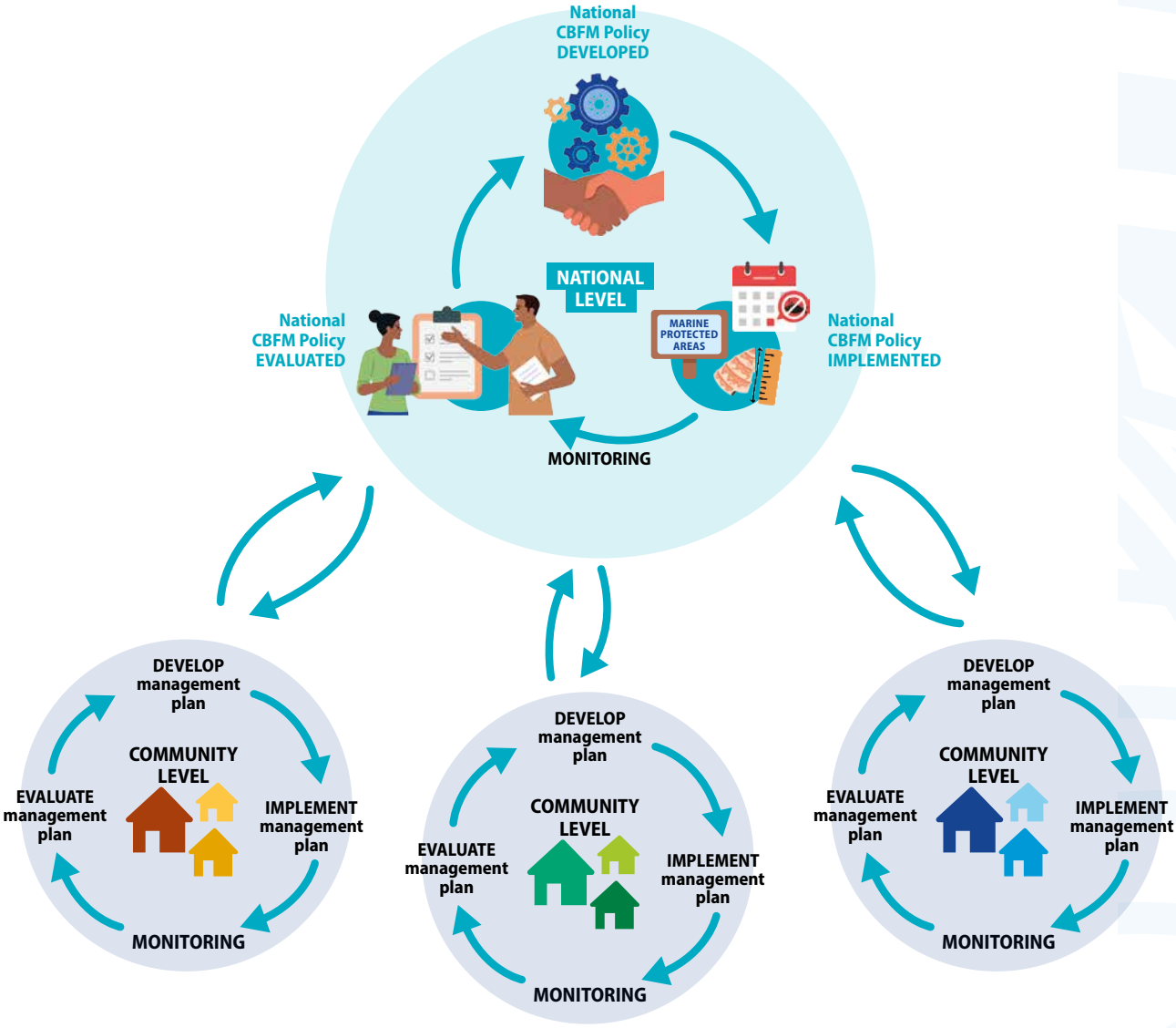
Tracking CBFM

Programme monitoring of CBFM at national level encompasses not only outcome monitoring but also the tracking of "inputs": the support that is provided to communities on CBFM by governments, NGOs/CSOs, or even other communities. This support may include the provision of information, the delivery of community workshops or training, participation in community exchanges, and networking or meetings. Tracking these CBFM "inputs" must be paired with monitoring "outcomes" (i.e. what changes the support has led to). Information to be tracked would include; where management measures or rules have been established, the number of communities with CBFM activities or the types of management in place. Outcome monitoring may measure behaviour changes within communities, increased awareness of the importance of CBFM or a summary of fisheries benefits seen across many CBFM initiatives. Tracking is key to understanding the most efficient and effective way to support the scaling of CBFM at national and regional scales.

A tiered monitoring approach for CBFM

Monitoring conducted at the community level can produce information that can be fed into evaluation of CBFM programmes. Intentionally ensuring that community and programme monitoring are complementary, or even nested, ensures that the community adaptive management is represented and used to inform programme monitoring and policy (Figure 1), and vice versa.

Figure 1. Illustration showing how CBFM community level monitoring may nest in national programme monitoring and policy development



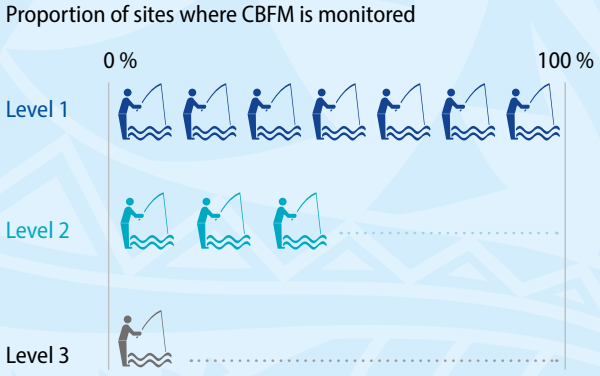
The early 2000s saw the rise of the CBFM movement in the Pacific region, notably in Fiji with the recognition of locally managed marine areas (LMMAs) in coastal fisheries management approaches and policies. With this came a need to monitor, evaluate and learn from the LMMA approach. The LMMA network connected communities with scientists that assisted with in-water monitoring, including training community members to conduct these surveys (Govan et al. 2011; Albert et al. 2016). As the number of LMMAs grew, however, demand for monitoring quickly exceeded the available technical and financial support. Communities that continued in-water surveys did so infrequently, regularly changing surveyors and survey methods, so results were unreliable and not comparable one year to the next. Furthermore, resulting data were rarely used to inform adaptive management due to limitations in available technical knowledge (Govan et al. 2011).

A solution proposed in Fiji, and more recently Tonga (Ford-Learner et al. 2024; Tonga Ministry of Fisheries 2025), is a strategic, tiered approach to monitoring, where all communities record their perceptions of change in resource status to inform local management rules. They also report these perceptions to CBFM programme coordinators. In parallel, status of resources is directly monitored in a subset of representative communities by programme monitors to inform broad-scale CBFM programme effectiveness. More costly academic research is conducted in a handful of locales to test the assumptions underpinning CBFM programmes (Figure 2).

The purpose of a tiered monitoring system is not to transfer responsibility for programme monitoring to communities. Community monitoring and programme monitoring serve different purposes and may require different indicators. Where possible, programme-level information needs should build on community priorities rather than create additional monitoring burdens.

This guide is designed to outline methods that can be used in monitoring plans for CBFM. Focusing both on methods appropriate for community-level monitoring towards local adaptive management, and methods that require more technical expertise and financial support contributing towards evaluation of CBFM or LMMA programmes across an entire nation.

Figure 2. Description of the tiered approach to monitoring



All communities track perceptions of CBFM effectiveness to inform local management efforts, and CBFM programme performance.

Some communities, often supported by external partners, and governments in selected sites, conduct direct monitoring of resource status to groundtruth perceptions of CBFM effectiveness, and understand CBFM programme performance.

Governments with support from scientists undertake monitoring in very few sites through intensive data collection to advance the knowledge on the effectiveness of management measures in various contexts, and test assumptions underlying CBFM approaches.

Monitoring design

What will be measured?

The data collected should be guided by the specific objectives that communities and CBFM programmes are seeking to achieve (Table 3, page 11). For example, if the objective of the management measures is to improve the catches of grouper, then monitoring needs to measure grouper and focus on landings data from fishers in lieu of in-water surveys.

Choosing what to measure tends to be easier if management rules are specific, but, in reality, CBFM plans tend to have general and diverse objectives. In these cases, decisions need to be made about what is most important to measure: in-water health of fish, or the size and abundance of caught fish, or the habitats, or the socio-economic benefits. Selecting simple indicators that can be measured often (weekly or monthly) is preferable to more complex, in-depth studies that can be carried out only once every few years.

In CBFM programmes across multiple communities, the data collected should help to evaluate the programme theory and track its implementation. In practice, a monitoring plan may balance both data collected to understand performance of individual CBFM areas, and the progress of a CBFM programme. It must be noted that priorities at the local level may differ from national CBFM objectives, and compromises may have to be made in designing monitoring programmes to balance national and local information needs.

Choosing indicators

An indicator is a unit of information measured over time that documents change in a specific condition (Wongbusarakum and Pomeroy 2008). A good indicator meets the following criteria (Margoluis and Salafsky 2010):

- **measurable** – able to be recorded and analysed in quantitative and qualitative terms;
- **precise** – defined the same way by all people;
- **consistent** – not changing over time so that it always measures the same thing;
- **sensitive** – changing proportionately in response to actual changes in the item being measured; and
- **simple** – simple indicators are preferred to complex ones.

Many indicators can be used to monitor the changes resulting from CBFM. The Learning Framework developed by the LMMA Network has over 90 indicators listed (LMMA Network 2003). In practice, very few of them are being used in the current monitoring effort. Table 3 provides some examples of indicators that can be used to monitor CBFM outcomes based on commonly used management objectives (Jupiter et al. 2014). One or more of these indicators may be chosen, depending on the capacity available for monitoring, and the management objectives chosen. It is important to ensure that, when collecting catch or perceptions data, the gender and age of the interviewees are also recorded to see if opinions of social groups differ. The objectives shown below are examples only; communities may identify additional objectives and should select indicators that best reflect their own management priorities.

Sometimes, additional indicators are measured to help explain change. For example, an indicator may be "total weight of fish caught per fisher" before and after new management rules were introduced. But just after the introduction of new rules, there was a storm that damaged the habitat, so you also measure "coral cover" to understand whether changes in catch were because of new management rules or because of habitat change. The decision to include more indicators in the monitoring plan depends on what may influence the effectiveness of the management rules and how much time, expertise and money are available to support their long-term measurement. These considerations for each method are outlined in Table 4.

Table 3. Management objectives and examples of indicators for CBFM initiatives with associated method sheets[1]

Management objective	Example indicators	Relevant method sheets in this guide
Increase long-term sustainable fisheries yield for cash and food	Number and size of fish caught for food	MS5 (p.28), MS6 (p.30), MS7 (p.33), MS8 (p.35), MS9 (p.37)
	Number and size of fish caught for income	MS5 (p.28), MS6 (p.30), MS7 (p.33), MS8 (p.35), MS9 (p.37)
	Household or fisher income from fishing	MS13 (p.52), MS14 (p.54), MS15 (p.56)
Increase efficiency of harvests and recovery of fish populations for short-term gain or contingency needs	In-water biomass or abundance of fish/invertebrates	MS1 (p.16), MS2 (p.18), MS3 (p.21), MS4 (p.23)
	Number and size of fish caught	MS5 (p.28), MS6 (p.30), MS7 (p.33), MS8 (p.35), MS9 (p.37)
Maintain/restore biodiversity, habitats and ecosystem function to improve resilience	In-water biomass or abundance of fish/invertebrates	MS1 (p.16), MS2 (p.18), MS3 (p.21), MS4 (p.23)
	Coral cover (or other indicator of habitat status)	MS5 (p.28), MS6 (p.30), MS7 (p.33), MS8 (p.35), MS9 (p.37)
	Diversity of species in an area	MS1 (p.16), MS2 (p.18), MS3 (p.21), MS4 (p.23)
Maintain/restore biomass and breeding populations of targeted species	In-water biomass and abundance of fish/invertebrates	MS1 (p.16), MS2 (p.18), MS3 (p.21), MS4 (p.23)
	Number and size of targeted fish caught	MS5 (p.28), MS6 (p.30), MS7 (p.33), MS8 (p.35), MS9 (p.37)
Enhance economy and livelihoods	Fisher or household income from fishing activities	MS13 (p.52), MS14 (p.54), MS15 (p.56)
Maintain or reinforce customs and traditions	Access to sites of cultural importance	MS13 (p.52), MS14 (p.54), MS15 (p.56)
	Evidence of incorporation of traditional approaches to fisheries management	MS13 (p.52), MS14 (p.54), MS15 (p.56)
Assert access rights	Number of "outsiders" accessing resources	MS13 (p.52), MS14 (p.54), MS15 (p.56)
Increase community organisation, cohesiveness and empowerment	Perceptions of community cohesion, organisation or empowerment	MS13 (p.52), MS14 (p.54), MS15 (p.56)

When will indicators be measured?

The frequency of monitoring depends on how soon a change is expected and the level of detail needed to understand trends.

Ideally, the first measurement should be done prior to the implementation of any new management rules to have a baseline against which changes can be compared. After that, most monitoring should be done at least once a year, at the same time each year (LMMA Network 2003). For some methods, such as catch monitoring, more frequent data collection (monthly to weekly, depending on financial and human capacity) is advised to best capture seasonal changes in fishing activity or fish abundance.

[1] Objectives from Jupiter et al 2014. The indicators suggested are not intended to be an exhaustive list, other sources of indicators include the LMMA Network Framework (LMMA Network 2003), and the Socioeconomic Monitoring Guidelines for Coastal Managers of Pacific Island Countries (Wongbusarakum and Pomeroy 2008). Note that some methods may need to be adapted to ensure that questions address example indicators above.

Where will the indicators be measured?

Like the "what to measure", the "where to measure" is tied to the management rules in place, and the methods chosen for monitoring.

For example, if the objective of CBFM is to improve catches, catches would be monitored in one or multiple locations where fishers would be found after fishing; landing sites, fisher households or markets. Fishers may even proactively be called to take part in interviews or discussions after returning from fishing.

If the management objectives are about improving the biomass or abundance of fishes, in-water monitoring might be considered, both inside and outside the tabu area/reserve. Monitoring resources in tabu areas and fishing grounds may be necessary to better understand the result of catch monitoring and assist the adaptive management discussions. However, the survey locations need to be carefully planned, based on the species targeted by management (so that their habitat is included), and to ensure that there are control sites as comparison points. To make sure the survey locations are placed in the correct habitat for the species of interest, local fishers can be consulted and reference materials, such as Pakoa et al. (2014), drawn on.

Controls and baselines

A "control" is a time or place used as a comparison point to help separate change happening because of new management rules from change happening due to other factors, such as weather, habitat, etc.

Controls can be put in place over space, e.g. comparing perceptions of fish abundance inside vs outside a managed area; or over time, e.g. comparing the catches of fish before vs after the banning of a certain fishing method (the "before" measurement is often referred to as a baseline). Having comparison points over time and space is best practice and lets us separate the influence of management from the influence of habitat or other factors (Miller and Russ 2014).

In the case of a permanent closure, multiple control sites open to fishing may be needed at increasing distances from the closure location. In this case, one control site could be placed 100 metres away from the closure boundary, and another at least one kilometre from the closure boundary to assess the range of the spill-over effect and provide recommendations on closure size and spacing (Da Silva et al. 2015; Di Lorenzo et al. 2020).

When it comes to programme monitoring, the change in status of resources in communities undertaking CBFM may be compared with communities not yet managing their resources, or in the early stages of CBFM activities. The latter act as control sites.

How will the indicators be measured?

To support the selection of appropriate methods, Table 4 provides summarised information on the monitoring methods presented in this guide, alongside key considerations, such as cost, complexity and resulting data quality.

This table should be used as a starting point to select appropriate methods based on management objectives and the context of monitoring – whether this is to support community-level monitoring, or programmatic. More detail on the various methods is outlined, alongside the equipment needed, protocols, case studies and considerations for storing and analysing data. It is important that, once a particular method has been selected and implemented, the same method is used for every survey; otherwise, the data will not be comparable over time.

Table 4. Summary of information on monitoring methods

METHOD SHEET #	TYPE	METHOD	PAGE	COMPLEXITY*	COST	DATA QUALITY	LEVEL OF REGIONAL USE
		MONITORING FISH AND INVERTEBRATES IN THEIR ENVIRONMENT					
1		Focus group discussion (in-water status)	p.16				
2		Basic belt transects	p.18				
3		Interviews (in-water status)	p.21				
4		Advanced belt transects	p.23				
		MONITORING CATCHES					
5		Focus group discussion (catches)	p.28				
6		Basic catch surveys	p.31				
7		Fisher's logbooks	p.34				
8		Interviews (catches)	p.36				
9		Advanced catch surveys	p.38				
		MONITORING HABITATS					
10		Habitat observation	p.42				
11		Point intercept transect	p.45				
12		Quadrats	p.48				
		MONITORING THE SOCIO-ECONOMIC IMPACTS OF FISHERIES MANAGEMENT					
13		Focus group discussion	p.52				
14		Interviews (socio-economics)	p.54				
15		Household surveys	p.56				

** Complexity relates to the need to go through regular training or on-site support to implement the method and/or the need for data analysis to be undertaken by experts outside of the community.*

High score
Low complexity and cost, high data quality and widespread use.

Medium score
Intermediate cost, complexity, data quality and use.

Low score
High complexity and cost, low data quality and widespread use.

Community monitoring

Programme monitoring

MONITORING METHODS

Monitoring methods that are known to be used in the Pacific region for CBFM are presented here in sections, depending on what they measure.



fish and invertebrates in their environment



fish catches



habitats



socio-economic impacts

Each section details what information can be collected, and examples of where this has been used before. Methods are presented, depending on whether monitoring is more suited to communities, or fisheries or project officers as a part of a CBFM programme. Each method sheet outlines practical information on its implementation, including a protocol or links to further information, case studies and information on the complexity or associated costs. The method sheets, alongside Table 4, should help the user to assess how suitable each method is for their context.



MONITORING FISH AND INVERTEBRATES IN THEIR ENVIRONMENT



Monitoring marine resources in their environment provides information on fish or invertebrate abundance and size/biomass. Additional information can be collected on diversity, the presence or return of species of interest that have not been seen in the fishing grounds for some time, and fish behaviour. Management is usually done to understand if changes in fish/invertebrate stocks were due to habitat change or other factors.





Method sheet 1

Focus group discussion (in-water status)

Monitoring conducted by the community

Monitoring fish and invertebrates in their environment

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
1 Focus group discussion (in-water status)				The management committee collects fishers' observations of in-water resource status through focus group discussion.	Currently used informally in a lot of communities but not officially integrated in any monitoring programmes.

High score Medium score Low score

BASIC DESCRIPTION

Data collected	Perceptions of in-water fish/invertebrate abundance and size
Protocol	Conduct focus group discussions with fishers on their perceptions of fish populations and sizes. An alternative is to conduct interviews.
Number of people required	Two people: one to ask questions and one to take notes
Time	30 minutes per group if doing group discussions
Equipment	Notebook or data sheets (see Appendix 1) Pencils
External support for community monitoring	Basic introduction to methods and example data sheets may be needed that could be copied into notebooks.

PROTOCOL

Option 1: group discussion with fishers

1. Invite fishers to a group discussion. These can be separate groups for women, youth and men, or one large group made up of many different people.
2. As a group, discuss the answers to the questions and record what is decided on, alongside the date.

Option 2: interviews

3. Print or write out questions.
4. Interview fishers from the village, recording their answers.
5. Men, women, and youth, as well as a mix of people of different ages and who fish for different things, all need to be included in the survey. Aim to interview at least five people per group – the more interviews, the better.

CASE STUDY

In the traditional *ra'ui* of the Cook Islands, people from the community are tasked to observe the resources in those areas and report back to the management committee. These areas are opened or closed, depending on their observations (George Tapai Kakara, pers comm). Observations made by fishers are shared during village meetings and up to district level. In French Polynesia, discussions about perceived state of resources are centred around underwater videos taken in the no-take area, using simple cameras (E. Vernier, pers. comm.).

Tips to collect good data

If there is no clear conclusion from the responses to interview questions, the data collector should talk to more people to see if any trends emerge.

If a no-take area is in place, management committee members and fishers can snorkel in the area and fishing grounds around it before sharing their perceptions as a part of focus group discussions.

DATA STORAGE AND ANALYSIS

Data can be stored in a dedicated notebook kept by the management committee.

If using set questions, for each question, the number of responses per category should be summed. (Increased/Decreased/No Change or Yes/No).



Photo Pauline Bosserelle ©SPC

Method sheet 2

Basic belt transects

Monitoring conducted by the community

Monitoring fish and invertebrates in their environment

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
2 Basic belt transects				Counting fish and invertebrates inside a corridor marked by a transect tape or rope	New Caledonia (34 communities), Vanuatu (30 communities), Solomon Islands (4 districts), RMI (14 municipalities), FSM (6 communities), Samoa (8 communities), Palau, Fiji, Wallis, French Polynesia

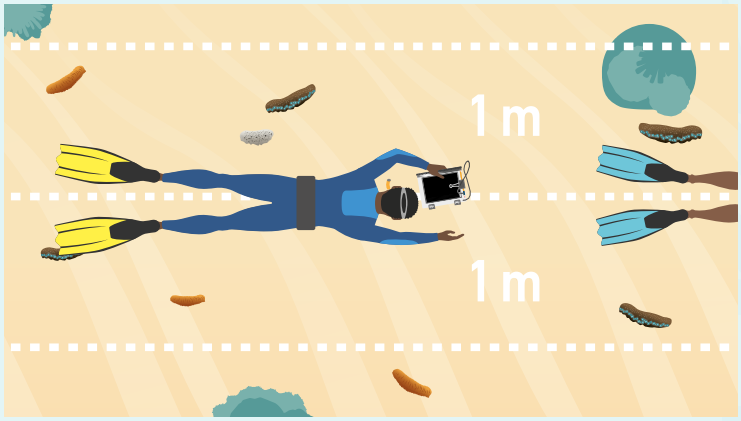
High score Medium score Low score

BASIC DESCRIPTION

Data collected	Counts of invertebrates and/or fish of interest to each community
Number of people required	At least three people are required – two surveyors and one boat driver – to reach the reef/survey site. Sometimes a boat driver is not needed.
Time	1 to 2 hours per survey site
Equipment	• Measuring tape or rope of the transect length • Data sheet on waterproof paper mounted on survey slate (see Appendix 2) • Pencil • Mask, snorkel and fins Optional: • Species ID cards or resources • Concrete reinforcing bars to make the transect permanent • GPS unit to mark the transect start and end points
External support for community monitoring	• Training in methods and species ID • Provision of survey equipment and ID materials • Recommended on-site supervision during surveys • Support could also include printing data collection sheets, conducting analyses, producing reporting posters and calling community representatives to remind them that it is time to do the survey (Devine J., Jaugeon B., pers comm).
Protocol	This method is used to count the number of invertebrates or fish of interest using transects on exposed reef flats, or in 2–3 m of water.

PROTOCOL

1. Surveys should be conducted in habitats where target species are found.
2. The survey site is located, either by using GPS points, metal rebars put in place previously to mark the site, or by choosing an approximate location in an appropriate habitat according to local knowledge.
3. If swimming, be aware of sea conditions and stay aware of where the boat is. If walking, make sure to wear protective footwear and a hat.
4. One person lays down 40 m of transect tape or rope (Pakoa et al. 2014), then waits 10 minutes for fish to return if counting fish.
5. Swim along transect line, looking 1 m either side of the line for invertebrates (checking inside holes and corals as per Pakoa et al. 2014), or 2.5 m either side of line for fish. If counting both, one surveyor counts fish and the other counts invertebrates.
6. If interested in the size of animals, for invertebrates, a ruler can be brought on the survey to record this information, or for fish, their length can be estimated as follows:
    a. Size 1: finger length
    b. Size 2: hand length
    c. Size 3: forearm length
    d. Size 4: full arm length
7. Write down all observations on a datasheet mounted on an underwater slate (Appendix 2), or other recording tool (see case studies).
8. Repeat until there are between four and six transects completed for that location, each transect should be 5–10 m away from the previous one.



CASE STUDY

Most organisations contacted for the development of this guide reported that they are no longer supporting communities to conduct regular in-water surveys themselves, mostly due to the cost and time involved in supporting long-term monitoring programmes in remote areas.

Today, there are a handful of communities monitoring their resources themselves using belt transects, with some level of external support. New Caledonia has 34 sites monitored through a local coral reef monitoring network *(Réseau d'Observation des Récifs Coralliens 2023)* supported mainly by public funding and volunteers. In Solomon Islands, WWF and the Solomon Islands Ranger Association are supporting rangers to implement monitoring in 14 and soon 18 communities (H. Kaniki, pers comm) and the Wildlife Conservation Society is supporting four districts in Solomon Islands to use the C2O Pacific Toolkit to monitor invertebrates using belt transects. This toolkit has also been used in Vanuatu (30 communities), the Republic of Marshall Islands (14 municipalities) and more recently in Wallis and Futuna and French Polynesia. In Pohnpei, three communities are regularly monitoring their LMMAs with support from the Conservation Society of Pohnpei (E. Joseph, pers. comm). In Samoa, the CSO Reefs of Hope is providing training and support to conduct fish counts using belt transects in seven communities across Lefaga Bay and 1 in Apia (F. Faletoese, pers. comm).

Other in-water survey methods exist in the literature for CBFM, e.g. timed swims, fixed-point counts (Job Unpublished) or "Set Path" methods (Fisk 2007). However, there are few examples of their use by communities, apart from the Vanua-Tai network in Vanuatu, who report using timed counts to assess parrot fish populations in North Efate (D. Aromalo, pers comm).

Tips to collect good data

Surveys should take place in the same month/season each time the monitoring occurs, preferably every year (Wilson and Green 2009).

Community members who harvest invertebrates should be the ones to implement the monitoring; they would know where the animals are found and will be good at identifying them. However, they should not harvest during the survey!

Printing waterproof data sheets is not always possible in remote areas. White plastic plates or chopping boards can be sanded and then used as underwater slates. Data sheets can be drawn on in pencil, used for the survey and then copied into notebooks before being re-used. In some areas, coconut fronds are used to count animals encountered; the number of invertebrates is marked on the fronds with fingernails.

DATA STORAGE AND ANALYSIS

The data can be entered into a notebook and communicated on a message board in the village. Both the book and/or the board can be photographed with a phone to keep back up.

The average of all transect counts can be calculated per species, per site. The counts for all transects for each site are added, then divided by the number of transects conducted, or the area that was covered by all transects.



Method sheet 3

Interviews (in-water status)

Programme monitoring | Monitoring fish and invertebrates in their environment

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
3 Interviews				Programme officers interview a management committee representative or fishers to understand perceptions of in-water resource status.	Perceptions of stocks are collected in Tonga as part of the quarterly visits to communities that are implementing management. French Polynesia also collects similar information but only in one community at this stage.

High score | Medium score | Low score

BASIC DESCRIPTION

Data collected	Perceptions of in-water fish/invertebrate abundance and size
Number of people required	Two people: one to ask questions and one to take notes
Time	10 minutes per interview
Equipment	• Notebook or data sheets (see Appendix 1) and pencils • Optional: Tablet or smartphone with Kobo Toolbox survey available
Protocol	A programme/fisheries officer does a short interview with the management committee on their perceptions of fish/invertebrate populations and size in their managed areas.

PROTOCOL

1. Programme or fisheries officer organises a time to speak with the management committee or community members.
2. The group or interview individuals discuss their perception of in-water fish/invertebrate populations using standardised questions. These questions are similar to MS1 and can be found in Appendix 1.
3. Answers to questions are recorded, either on paper data sheets or using a tablet/phone with KoboCollect or alternative software.

CASE STUDY

This interview method is based on the questionnaires recently reviewed and adapted for the Tonga SMA scaling strategy (Tonga Ministry of Fisheries 2025) and the Fiji LMMA Network questionnaire developed in 2009 (FLMMA 2009). In 2012, the implementation of the FLMMA survey across 117 villages and four provinces showed that 57% of the communities perceived an increase in the abundance and size of fish because of management (FLMMA 2012).

The French Polynesia fisheries department has developed a standardised form to support fisher interviews. It includes a section on fisher perceptions of the impact of their managed areas on fish populations. The questionnaire has been piloted in two communities so far, with adaptation and extension to other communities planned (M. Verducci, pers. comm. 2025). Results in one of the communities surveyed in mainland Tahiti showed that 49% of fishers perceive that local management is not effective in increasing fish populations in the fishing grounds (Wencélius 2022).

The results of perceptions surveys are not as reliable as quantitative in-water counts of abundance but can provide information over large spatial scales, at little cost, to indicate where further investigation or other monitoring may be needed.

Tips to collect good data

Conducting these interviews can be included in the routine of each fisheries officer when visiting a community or attending a community event.

Free, easy-to-use software is available to create electronic data collection forms that can be used in the field. For example, Kobo Toolbox is an open-source form-creation software, when paired with the app KoboCollect on a phone or tablet, it can be used to collect data offline.

DATA STORAGE AND ANALYSIS

Data should be stored digitally in spreadsheets or a database if available. These should be backed up regularly to the cloud. If paper data sheets are used, photos of them should be taken and backed up on a hard drive or online to avoid their damage and loss.

Results of questionnaires are analysed by adding up responses to each question and displaying these in simple bar charts. Answers can be compared from one visit or meeting to another, if there are changes over time.



Photo Hannah Gilchrist ©SPC

Method sheet 4

Advanced belt transects

Programme monitoring | Monitoring fish and invertebrates in their environment

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
4 Advanced belt transects				Counting and recording the size of fish and/ or invertebrates inside a corridor of set width marked by a transect tape or chainman	Cook Islands, Fiji, Solomon Islands, French Polynesia, Guam, Kiribati, FSM**, Samoa*, Tonga, Vanuatu, Wallis and Futuna, Palau, CNMI**, RMI**.

* Implemented regularly since 1995 - **Implemented regularly under Micronesia Challenge since 2007

High score | Medium score | Low score

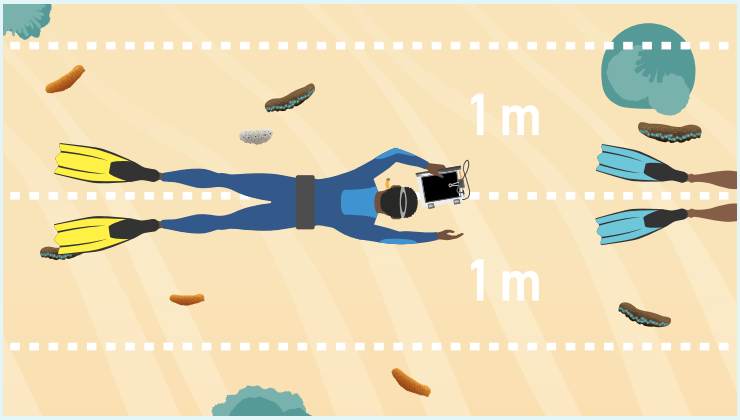
BASIC DESCRIPTION

Data collected	Abundance, density and size of invertebrates or fish
Number of people required	3 or 4: one diver records fish numbers, another records invertebrate numbers, a third lays out the transect line and takes habitat photos. A boat captain may also be required.
Time	1 to 2 hours per site
Equipment	• Measuring tape, or belt chainman • Data sheet (see Appendix 3) • Underwater slate • Ruler (for invertebrate surveys) • Pencil • Scuba equipment • Underwater camera • Boat to access survey sites • GPS to mark the site start and end points • Fish or invertebrate ID materials
Protocol	This method involves laying out transects in the habitat of target species. Using scuba, swim along the transect recording the size and quantity of fish/invertebrates observed (1 m either side of the transect for invertebrates, to 2.5 m either side for fish).

PROTOCOL

Belt transects are widely used to monitor the status of marine resources. It requires well-trained, scuba-certified observers with specialised equipment. These surveys are sometimes carried out using snorkelling equipment in shallow waters (<2 m) and good surface conditions.

1. The site is located using a GPS unit and past knowledge of the location in relation to surrounding reef or island structures. Upon reaching the site, a weight attached to a surface float is deployed to mark the start of the survey, a GPS point is also recorded to mark this location.
2. The surveyors enter the water and secure the start of the transect tape. They record the date, the name of the site, the transect number, start time, visibility and the name of the observer.
3. The surveyors swim in a straight line following a depth contour for 40 m (the transect length can be adapted from 20 to 50 m), counting all targeted fishes sighted within the area 2.5 m either side of the centre line. The length of each fish is also estimated in 5 cm bins.
4. (Optional) A second surveyor follows, laying the tape as they swim. This surveyor also takes images of the substrate every 2 m, from a consistent distance away.
5. If monitoring invertebrates as well, a third surveyor is required. They search 1 m either side of the transect for target species. Different transect widths may be required, depending on the target species. (See Pakoa et al. 2014 for more detail.) Invertebrate sizes are measured with a ruler attached to the survey slate.
6. Once a transect is complete, record any additional habitat or depth information, collect the survey tape, then begin a new transect 5 –10 m further on from where the first transect ended. After completion of three to six transects, the surveyors ascend and exit the water. A GPS point is recorded, marking the end of the survey.



CASE STUDIES

In-water surveys are conducted in various ways; they differ from place to place and organisation to organisation (Samoilys and Carlos 2000). The key is to pick a method that is suitable for the target species and be consistent in how it is applied, instead of adjusting methods year after year.

Fisheries departments across the region, alongside NGOs/CSOs, universities and regional agencies, have used belt transects of varying lengths and widths to monitor both fish and invertebrate statuses for several decades. These surveys are used to inform national stock or ecosystem health assessments, instead of the sole purpose of evaluating CBFM effectiveness. Examples are the Micronesia Challenge (Houk et al. 2015) and SPC's SciCOFish project (SPC 2015). In-water assessments to evaluate CBFM effectiveness include recent work conducted in collaboration with Tonga and James Cook University (Smallhorn-West et al. 2020).

Tips to collect good data

Surveyors must be able to ID target species with accuracy before surveys begin. The Pacific Community has developed an app that can be used to practise fish identification of commercial species in the Pacific seas (Pacfishid App). Species ID cards can be printed on waterproof paper to facilitate surveys (Pakoa et al. 2014).

To ensure that length estimates are valid for fish surveys, training should be conducted at the start of every trip using plastic fish models of known lengths. Observers estimate the length of each model held up randomly until estimates are consistently within 2 cm of the known lengths. Estimates should be compared between observers to ensure that there are no consistent biases.

DATA STORAGE AND ANALYSIS

Data are stored in Excel files or a database, such as that hosted by SPC, and should be digitised the day the survey was conducted to avoid loss of information.

Analysis is usually done by experts, as it requires proficiency in statistical analysis and GIS software. Though specifically developed for invertebrate data analysis, the appendices of Pakoa et al. (2014) outline simple data analysis steps using Excel to calculate densities and create size distribution charts that could apply to any count data from transects;



Borne © SPC

Monitoring catches

An alternative to an underwater visual census is to focus on monitoring catches to assess the health of fish stocks and the benefits of fishing to fishers. Monitoring catches can provide information on the number and size of fish caught, income from fishing, and fishing effort.



Method sheet 5

Focus group discussion (catches)

Photo William Sokimi ©SPC

Monitoring conducted by the community **Monitoring catches**

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
5 Focus group discussion				The management committee collects fishers' perceptions of their catches through focus groups discussions or interviews held at least once a year.	Currently done informally in a lot of communities but not officially integrated in any monitoring programmes.

High score Medium score Low score

BASIC DESCRIPTION

Data collected	Perceptions of fish and invertebrate catches volume and weight
Number of people required	Two people: one to ask questions and one to take notes
Time	10 minutes per fisher for interviews 30 minutes per group if doing group discussions
Equipment	Notebook or data sheets (see Appendix 4) Pencil
External support for community monitoring	Basic introduction to methods and example data sheets that can be copied into notebooks may be needed.
Basic protocols	Interview fishers on their perception of fish/invertebrate catches or conduct a group discussion to reach consensus.

PROTOCOL

Option1: interviews

1. Print or write out questions.
2. Interview fishers from the village, recording their answers.
3. Men, women, and youth, as well as a mix of people of different ages and people who fish for different things, all need to be included in the survey. Aim to interview at least five people per group – the more interviews, the better.

Option 2: group discussion with fishers

1. Print or write out questions.
2. Invite fishers to a group discussion. These can be separate groups for women, youth and men, or one large group made up of many people who target different species or use different fishing gear.
3. As a group, discuss the answers to the questions and record what the group decides, alongside the date.

CASE STUDY

For community monitoring, the simplest method involves fishers reporting perceived changes in their own catches to the local management committee. In Fiji, WWF and Conservation International reported that communities in Lau and around the Great Sea Reef are doing informal monitoring of their resources through observations of changes in the size of catches or species, locations where catches were made and other observations, such as coral bleaching (U. Malaini and K. Miles, pers. com.). Observations made by fishers are shared during village meetings and up to district level. Some studies show consistency between scientific results and fishers' perceptions, revealing that fisher perceptions can sometimes detect emerging issues or trends (Rochet et al. 2008; Ruano-Chamorro et al. 2017; Zamborain-Mason et al. 2025).

The methods outlined here are based on surveys conducted through the Tonga Special Management Area scaling strategy (Tonga Ministry of Fisheries and Vava'u Environmental Protection Association 2016) and the Fiji Locally Managed Marine Area programme (FLMMA 2009). The method outlines different ways for a local management committee to understand fisher perceptions of catch volumes, ranging from interviews, to focus group discussions, or self-reported observations by the committee itself.

Tips to collect good data

While conducting the interviews, if there is no clear trend observed in the responses, it is useful to add more surveys to ensure that this is not due to insufficient number of people interviewed, instead of there being no trend at all.

Results may be more useful if questions focus on three to five key target species that are fished all year round and are identified as "priority" species by the management committee.

DATA STORAGE AND ANALYSIS

Data can be stored in a book, in the Notes App of a cell phone, or online, e.g. Google Drive, Dropbox.

If using structured questions from Appendix I, the analysis involves adding up the number of responses per category in a table that could be organised as shown below.

SPECIES	Gear	improved a lot	improved a little	No change	Declined a little	Declined a lot
Rabbit fish	hook and line	I		III	II	
Parrot fish	speargun	I	IIIII	I		
...						



Photo: Pauline Bosserelle ©SPC

Method sheet 6

Basic catch surveys

Monitoring conducted by the community | **Monitoring catches**

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
6 Basic catch survey				Monitoring of the catches of fishers on a regular basis, including measuring the lengths of species caught	Marshall Islands, Vanuatu, Solomon Islands, Wallis and Futuna, French Polynesia/ 35 communities involved in Vanuatu since 2016, 14 municipalities in Marshall Islands since 2021 and 4 districts in Solomon Islands since 2023

High score | Medium score | Low score

BASIC DESCRIPTION

Data collected	Volume, species and size of target fishes/invertebrates
Number of people required	One or two to conduct surveys and measure fishes
Time	15 minutes per survey with each fisher
Equipment	• Fish measuring ruler/measuring board • Field survey sheet • Pencil • Fish identification sheet
External support for community monitoring	Development of country-specific toolkit and selection of target species, training in methods for community representatives, provision of data collection sheets and reporting templates, refresher training
Basic protocols	Each surveyor to carry out surveys in their local community by meeting fishers with their catch when they return to shore from fishing. Using the survey form, surveyors collect information about the fishing trip that each fisher has just completed. This will include information on what species were caught and their size.

Monitoring conducted by the community

PROTOCOL

Community representatives collect data on the size and species of fish caught from at least 20 fishers every six months. The full description of the protocol is available in any of the community marine monitoring toolkits developed for Vanuatu, Solomon Islands, Republic of Marshall Islands, French Polynesia and Wallis and Futuna. To use this method, the size at which each species reaches maturity for the country, or the minimum size used in national regulations need to be known. Using data collection sheets, the outlined protocol below must be followed. The facilitators guide has more detail.

1. Before starting the survey, explain its purpose and the fact that it is voluntary and that the information collected will not be linked to their name.
2. Ask and fill in basic information, such as date, time, name of fisher, gender, village.
3. Ask and fill in information about the fishing trip, such as duration, main method/gear used.
4. Measure the fish targeted in the survey form. The targeted species or families are tailored to each country, based on local stakeholder consultations.

CASE STUDIES

Measuring the size of caught fish is a well-established way to monitor fishery health in places where funding or technical capacity is limited, so long as samples are collected regularly (Gulland and Rosenberg 1992). Size data shows whether fish are being caught after reaching maturity, which means they have had a chance to reproduce (Prince 2017). If catches are made up of smaller fish, it is a sign that fish have not yet reproduced, and that the fishery is becoming depleted. As large fish become scarce, fishers respond by targeting progressively smaller fish (Pauly et al. 1998; Prince et al. 2020), compounding the problem.

Several tools are used in the monitoring of fish catches. The C2O Pacific Toolkit relies on having information about size-at-maturity based on national laws and scientific studies for several countries and territories, including Vanuatu, Solomon Islands, Republic of the Marshall Islands, Wallis and Futuna, French Polynesia, and Fiji (Johnson et al. 2020; Ministry of Fisheries Fiji 2022; Johnson and Welch 2024; Johnson et al. 2018). The communities implementing the toolkit in these countries benefit from the support of NGOs and local governments.

One challenge in implementing this method is the lack of established size-at-maturity for many species at a national level. In 2017, fishers from Moorea, French Polynesia decided on minimum sizes through community discussion. Fishers brought key species they had caught to a community meeting; they measured and weighed the fish and shared their knowledge and experience about the species in the room. Together, they agreed on minimum sizes for fish to be sold. While there is a risk that such sizes might be set too low, there is still value in bringing fishers together to discuss fish sizes and draw on the experience of both younger and older generations (G. Sao Chan Cheong, pers. comm. 2024).

Tips to collect good data

Fishers surveyed should include those using a range of fishing practices.

Although a sample of 20 fishers every 6–12 months is suggested in the C2O Pacific Toolkit, more surveys will lead to more reliable results.

A fish identification guide should be carried by the surveyor to ensure accuracy of the data.

DATA STORAGE AND ANALYSIS

The data are ideally analysed and stored on Excel spreadsheets hosted by a government or NGO. Fully automated spreadsheets have been developed by C2O to facilitate data storage with a possible access to a database. If NGOs or government partners are involved in supporting communities in this programme, monitors can send their data sheets to them to be entered, analysed and stored on their behalf. For more isolated communities, the method also comes with a description on how to carry out manual analysis of catch survey data using a "Catch Survey Data Analysis Sheet".

Table 5: Data analysis example adapted from the C2O Pacific Toolkit

FISH SPECIES GROUP	CRITICAL SIZE	TOTAL NUMBER OF FISH		
		Larger or equal to the critical size	Caught	% larger than the size limit
Surgeonfish	20	3	12	25%
Snapper	20	3	4	75%
Grouper	25	0	4	0%
…				



Method sheet 7

Fisher logbooks

Monitoring conducted by the community **Monitoring catches**

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
7 Fisher logbooks				Fishers record information about their catches in logbooks.	Tonga, French Polynesia, FSM

High score Medium score Low score

BASIC DESCRIPTION

Data collected	Catch composition, size and fishing effort
Number of people required	No additional people to do surveys other than fishers themselves
Time	15 minutes per survey to fill in logbook
Equipment	• Notebooks or logbook templates • Rulers • Pencils • Fish identification sheet
External support for community monitoring	Training in methods, provision of data collection sheets, regular collection and digitising of logbooks, reminders to fishers and outreach
Basic protocols	Fishers are supplied with standardised logbooks that they fill in to record their fishing activity and catch each time they return from a fishing trip.

CASE STUDIES

One way to record fish catches is through fisher logbooks – printed data sheets that fishers fill out after each fishing trip. These usually include information on the catch (such as weight and average size), fishing effort (gear used, number of fishers, time spent fishing), and the fishing location (area, habitat, and depth). This method is appealing because it does not require dedicated surveyors needing to go out and collect data. Instead, fisheries officers collect the logbooks or take photos of them to process and analyse.

While logbooks can provide useful data for management committees, organising the collection of log sheets and the analysis of information are often difficult and require resources. In Tonga, the Ministry of Fisheries has found that remote communities that rely heavily on fishing are often the most dedicated to tracking their catches. However, collecting the logbooks and processing the data remain a challenge (S. Afu, pers. comm. 2024). In Ulithi atoll in Federated States of Micronesia, fishers in four communities have been monitoring their catches using logbooks for 10 years with support from the local CSO One People One Reef (Crane et al. 2017). In each community, two or three people are involved in the monitoring, which consists of reaching out to fishers after their trip, collecting and validating the data. The paper sheets are then brought to the mainland and entered in a database. The local CSO analyses the data and reports back on the results each year. There is no direct payment to the members involved in the data collection, but One Reef One People provides fuel for the communities; this helps them fish further away from their usual fishing grounds (N. Crane, pers. comm.).

The incorporation of artificial intelligence into data collection tools presents opportunities to simplify and automate monitoring and analysing data such as the data in fisher logbooks (Tonga Ministry of Fisheries 2025). Key data on fish species and lengths could be captured from images and could be processed automatically into simple charts or trends for fishers or local management committees to see and use. However, this would require the development of dedicated applications for this purpose, stable internet connectivity, the provision of smart phones/tablets to communities, and training in both data collection and data interpretation.

Tips to collect good data

Training for fishers is required to ensure that logbooks are filled in effectively.

DATA STORAGE AND ANALYSIS

Data should be stored electronically, ideally in an online database, but also in spreadsheets if database capacity is not available.

Start analysing the data by calculating total counts of species caught, the average size of fish caught and time spent fishing, all disaggregated by the gender of the fisher and fishing gear used.



Photo Pakoa ©SPC

Method sheet 8

Interviews (catches)

Programme monitoring | Monitoring catches

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
8 Interviews				Programme officers discuss with the management committee or fishers to understand perceptions of catch trends.	Collecting perceptions of catches has been recommended in the Tonga SMA scaling strategy but has not been implemented yet.

High score | Medium score | Low score

BASIC DESCRIPTION

Data collected	Perceptions of fish and invertebrate catches
Number of people required	Two people: one to ask questions and one to take notes
Time	20 minutes
Equipment	Paper and pencil
Basic protocols	Programme officers interview the management committee representative and possibly fishers to gather perceptions of catch trends.

PROTOCOL

Data can be collected when visiting communities by proactively organising interviews with fishers at landing sites, or by aligning visits with community gatherings at fishing competitions, churches or other cultural events. The protocol would be as follows.

1. Programme or fisheries officers organise a discussion with a management committee representative and possibly fishers.
2. Individuals are Interviewed on their perception of their catch, using standardised questions. These questions can be found in Appendix 4.
3. Answers to questions are recorded, either on paper data sheets or using a tablet/phone with KoboCollect or alternative software, including SPC's Ikasavea mobile application.
4. These questions can be combined with those for other perception-based methods (MS3&MS8), although it is recommended to keep the questionnaire short and focused.

CASE STUDY

The *Ikasavea* community app has a fishing context survey that can be used to collect fishers' perceptions of changes in their catches and fishing behaviour over time. The collection of fisheries data using this app began in 2023 in six communities in Vanuatu and eight in Kiribati (Steenbergen et al. 2024).

The questionnaires recently reviewed and adapted for the 2025 Tonga SMA scaling strategy and the 2009 Fiji LMMA Network questionnaire are also designed to collect data on fisher perceptions (FLMMA 2009). The key difference between this approach and Method Sheet 5 is that, instead of community members filling in the questionnaire themselves, programme officers conduct interviews guided by these questions.

Tips to collect good data

Data collectors that establish a good relationship with fishers are more likely to be successful in their data collection activities. Being polite, efficient and respecting the fishers' time can make a big difference in the overall success of monitoring programmes.

DATA STORAGE AND ANALYSIS

Conducting these questionnaires can be included in the routine of each fisheries officer when visiting a community or attending a community event.

Free, easy-to-use software is available to create electronic data collection forms that can be used in the field. For example, Kobo Toolbox is an open-source form-creation software; when paired with the app "KoboCollect" on a phone or tablet, it can be used to collect data offline.

Basic automated analyses are available, both through Kobo Toolbox and Ikasavea. Summarising data into counts of responses per question is an easy start. Qualitative data that include long-form text answers require expertise in coding and qualitative data analysis.



Photo: James @SPC

Method sheet 9

Advanced catch surveys

Programme monitoring | Monitoring catches

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
9 Advanced catch surveys				Recording of fisher catches using tablets and a dedicated app (e.g. *Ikasavea*).	Vanuatu, Kiribati and Tonga conduct CBFM-specific surveys.

High score | Medium score | Low score

BASIC DESCRIPTION

Data collected	Catch composition, quantity and length of fish/invertebrates caught Fishing effort and methods Perception of short-term trends Habits of fishers and fisheries context
Number of people required	Two minimum: one to conduct interviews with fishers and to use the tablet, the other to handle and measure fish/invertebrates.
Time	15 mins per fisher to conduct a survey Focused sampling over two weeks per site, up to three times a year
Equipment	• Standardised measuring mat made of plastic tarpaulin • Fully charged tablet with Ikasavea installed and set up to survey. • Access to the internet: whether a sim card with credit, or community centre/fisheries office • Optional: Backup data sheets and pencils in case of issues with tablets
Basic protocols	Trained surveyors interview fishers when they come in from fishing and take photos of their catch on standardised mats using the Ikasavea application.

PROTOCOL

Protocols are all outlined in the *Technical Manual for Data Collectors* (University of Wollongong 2023a), including best practices and equipment needs. There is also a training manual available: *Training Manual* (University of Wollongong 2023b).

In brief, the survey involves the steps below.

1. A community awareness meeting to share information about the upcoming monitoring activities.
2. Waiting at an appropriate location to find fishers (men and women) as they return from fishing.
3. Catch survey: capture catch data by doing an interview with the fisher about their fishing activity, and take photos of their catch on a standardised survey mat, with the help of a tablet and the Ikasavea app.
4. Find an internet connection and upload the collected data for processing (incl. validation), analysis, reporting and storage. (Uploading can occur when internet connection is available; up to that point collected data can be stored on tablets).



CASE STUDY

Catch monitoring programmes are employed by governments and NGOs across the Pacific region. They are used to monitor national fisheries programmes, as well as to directly assess the effects of CBFM. Catch monitoring at landing sites collects data on the abundance, length and weight of species caught, and records information about the fisher, and fishing effort.

Application of technologies and artificial intelligence has streamlined this monitoring approach. Tablets have replaced paper log sheets and AI integrations have improved the speed and accuracy of species ID and fish measurements. One of these tools is the *Ikasavea* application developed by the Pacific Community (Campbell et al. 2024; Shedrawi et al. 2024; Andrew et al. 2020). The app can be used to monitor catches at landing sites, and has a specific module dedicated to CBFM catch monitoring that was co-developed with the University of Wollongong through the Pathways Project. Vanuatu, Kiribati and Tonga fisheries departments have been going out on the field to use the community module of *Ikasavea* in select communities spread across the country (Steenbergen et al. 2024). Fourteen additional Pacific countries or territories conduct landings surveys using *Ikasavea* to inform their national fisheries management efforts. The Pacific Community fisheries team at fame_support@spc.int can be contacted for more information.

Tips to collect good data

Female fishers and invertebrate collectors may feel more comfortable talking to female catch monitors for personal or cultural reasons. In this case, data collection would be most effective with either one or two female catch monitors, or with one male and one female catch monitor. The reverse may be true for male fishers and invertebrate collectors, who may feel more comfortable talking to a male catch monitor.

Communities may tell the survey team that different groups of fishers land their catch at different times of day and in different places. Based on this information, surveyors may be at different locations in the community at different times so that a good sample of species and fishing methods is captured.

DATA STORAGE AND ANALYSIS

All data are saved on tablets to be uploaded to the SPC Coastal Fisheries Database when connection to the internet is established. Once uploaded, survey data are saved, and images are processed using artificial intelligence (AI). AI will suggest an ID and length for each fish that needs to be validated by a fisheries or programme officer. Using information in the literature, the system also produces a weight estimate based on the length of each fish.

Raw data can be exported as an Excel sheet, a report can be run, and a Word document can be generated. These reports present some of the following information.

- Total number of fish caught
- Total weight of fish caught
- Catch by habitat
- Most commonly caught fish species
- Number of times fishing equipment was reported being used
- Number of males and females aware of CBFM regulations

More detailed information is available in the Digital support for data coordinators manual (University of Wollongong 2023c).

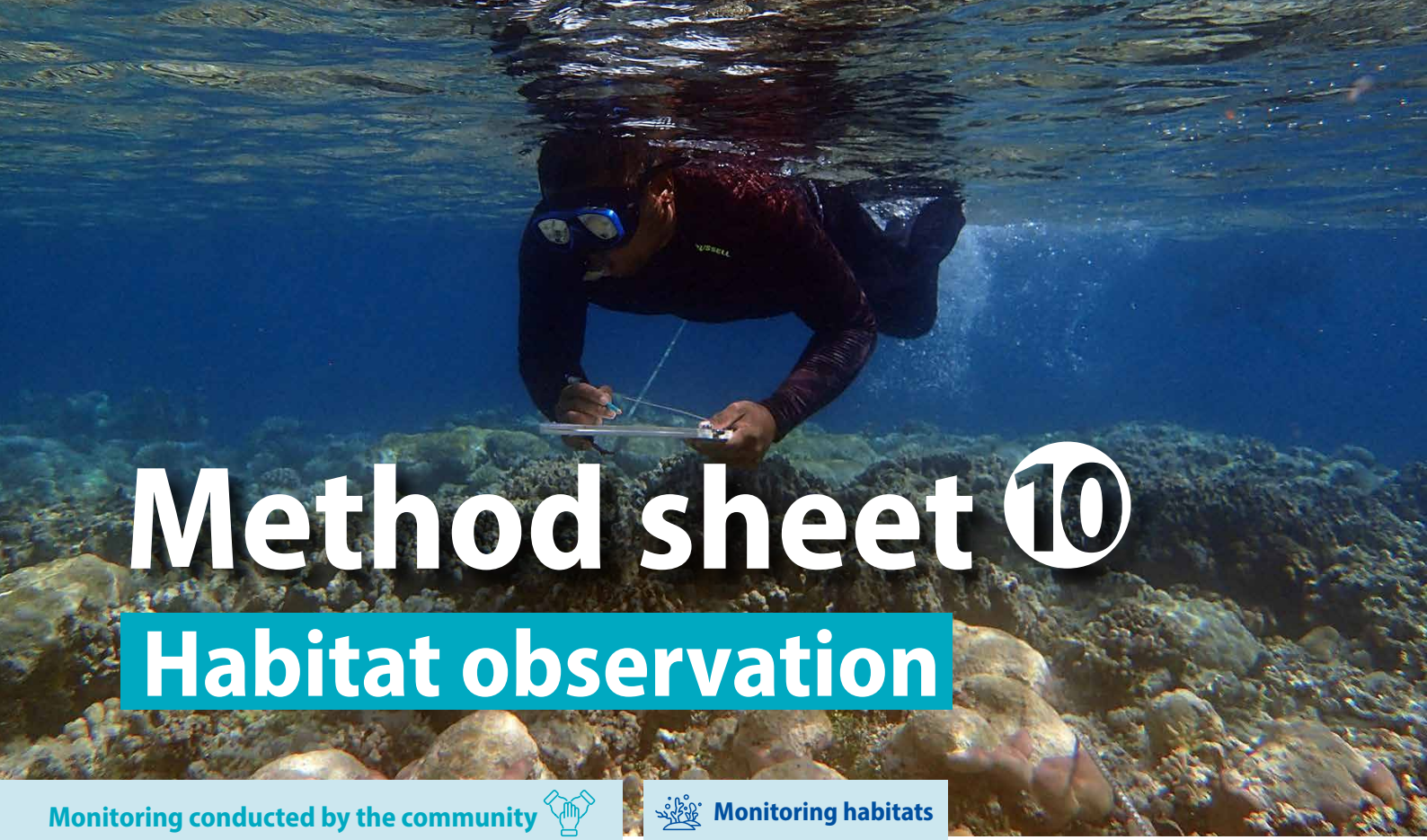


Photo © Rickard Abom (SPC)

Monitoring habitats

Monitoring habitats provides information on habitat health. Indicators tend to include **habitat complexity**, **coral or algal cover (habitat composition), levels of coral bleaching** or the presence of threats to reefs, such as population booms of **crown of thorns starfish**. CBFM sometimes includes objectives to improve ecosystem health, but monitoring habitats to inform fisheries management is usually done to understand if changes in fish/invertebrate stocks were due to habitat change or other factors.





Method sheet 10

Habitat observation

Monitoring conducted by the community

Monitoring habitats

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
10 Habitat observation				Underwater observation of coral reef status by community members during a set time or along a transect.	Vanuatu (35 communities since 2021), Marshall Islands (14 municipalities), Solomon Islands (4 districts since 2022), French Polynesia, Wallis and Futuna, FSM (6 sites)

High score Medium score Low score

BASIC DESCRIPTION

Data collected	In many places the only reef health indicator used is live hard coral cover. Other indicators can include: • habitat complexity • reef diversity • algae cover • bleached coral cover • proportion of broken hard corals • abundance of crown-of-thorns starfish (acanthaster planci) • presence of litter
Number of people required	Three: one boat captain if using a boat to access sites, two surveyors swimming together to observe the site.
Time	15 minutes per site Monitoring regularly every one to three years
Equipment	• underwater paper and slate • pencil • mask, snorkel and fins • waterproof watch for timed swims • guidance materials for estimating benthic cover Optional • GPS unit • Rope or measuring tape for transect swims
External support for community monitoring	Initial training for surveyors and indicator selection, reminders to conduct survey, provision of underwater paper and slates, storage of survey results, data analysis and interpretation, reporting posters.
Basic protocols	Snorkel survey the reef sites between two landmarks along a rope/transect tape of set distance, or swim around the site for 10–15 minutes and record general observations of habitat after completing the swim.

PROTOCOLS

This method involves community members swimming over selected survey sites and making observations to estimate reef health. Indicators can include live hard coral cover, reef complexity, reef diversity, and things like the presence of coral disease or bleaching, crown of thorns starfish, broken corals and even litter. For more detail on recording each indicator, refer to Appendix 5.

1. Select habitat indicators to focus on ahead of the survey, making sure that the correct data sheet(s) are printed on waterproof paper or copied onto survey slates (Appendix 5).
2. Locate the survey site, either by using GPS points or natural features.
3. Be aware of sea conditions and stay aware of where the boat or shore is.
4. Snorkel surveys should be done in water not exceeding ~ 5 m depth to ensure that substrate can be observed from the surface easily. Two surveyors conduct the survey at the same time.
5. If doing a timed swim at the site, start the stopwatch when ready, then swim around at a relaxed pace, observing reef status.
6. If swimming a set distance, either select two natural features to swim between that can be observed from the surface or lay a rope/transect tape of the desired distance. (The distance varies between case studies; swims should be at least 40 m).
7. During the swim, record observations of selected indicators. See Appendix 5 for detail alongside data collection sheets.
8. After the swim, both surveyors independently record observations on a datasheet mounted on an underwater slate.

CASE STUDY

Monitoring protocols to categorise habitat health are outlined in the C2O Pacific Toolkit deployed in several Pacific Island countries (e.g. Johnson et al. 2021; Johnson et al. 2023; Johnson and Welch 2025), and the *ABC des récifs* (Job Unpublished), a rapid assessment tool developed for use in the Loyalty Islands of New Caledonia. For both methods, thresholds/categories are set for each indicator that surveyors choose between during their surveys. For example, the scales for habitat cover in both approaches (poor health <10% cover; average health 10% to ~30%; good health >30%) are based on scientific monitoring results from country-specific baseline surveys, regional trends in coral cover (e.g. Wicquart et al. 2025), and globally recognised thresholds, (e.g. McClanahan et al. 2011).

Based on the Vanuatu experience, the coral reef survey module of the C2O Pacific Toolkit is used less than the catch survey module (Johnson et al. 2024). Field tests show that results generated using the C2O Pacific Toolkit show little variation from alternative survey approaches conducted by professionals (Johnson et al. 2024). At the time of writing, the rapid assessment tool developed for the Loyalty Islands (the ABC project) was not yet put into practice by communities.

Tips to collect good data

The location of surveys should be based on the knowledge of the community managing the area. Survey sites should include areas of particular interest, such as fishing zones, marine species nurseries, spawning sites and no-take areas.

DATA STORAGE AND ANALYSIS

When using coral cover scales, the survey results are reviewed through a consensus process, when all monitors come together to discuss the results and agree on a final score for each category. Results are then entered into a single survey sheet for each site. No further data analysis is required.

In New Caledonia, the number of categories observed is summarised below and a score is given, based on the scale below.

Number of habitat category recorded	Score
<= 4	Low
5–8	Moderate
>= 9	High

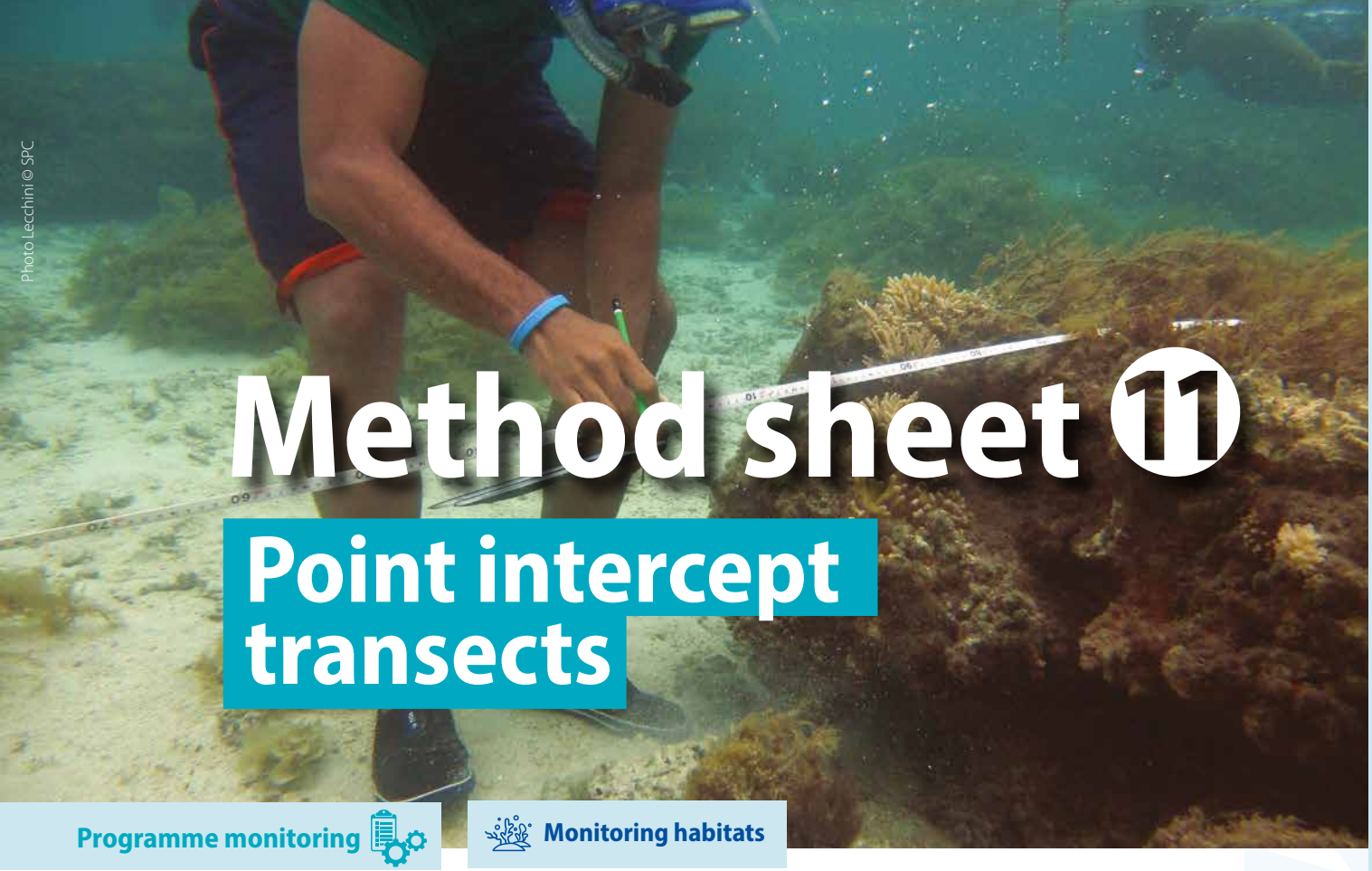


Photo Lecchini © SPC

Method sheet 11

Point intercept transects

Programme monitoring | Monitoring habitats

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
11 Point intercept transect				Recording habitat categories at set intervals along a transect tape	31 sites in New Caledonia since 1997, Solomon Islands

High score | Medium score | Low score

BASIC DESCRIPTION

Data collected	High-level substrate composition for any habitat type
Number of people required	Three: one boat captain if boat required to reach survey sites; two surveyors – one who lays the tape and another records their observations
Time	15 minutes per transect
Equipment	• Underwater slate and datasheets (see Appendix 6) • Pencil • Identification materials • Transect tapes, usually 100 m • Scuba or snorkelling equipment, depending on survey depth • GPS unit
External support for community monitoring	Training for surveyors, on-site supervision, data storage, analysis and interpretation
Basic protocols	Point intercept transects record what is observed under a transect tape at regular intervals over a set distance to understand substrate composition. The method is well suited to understanding high-level reef or substrate composition but lacks the resolution to calculate indicators like seagrass density.

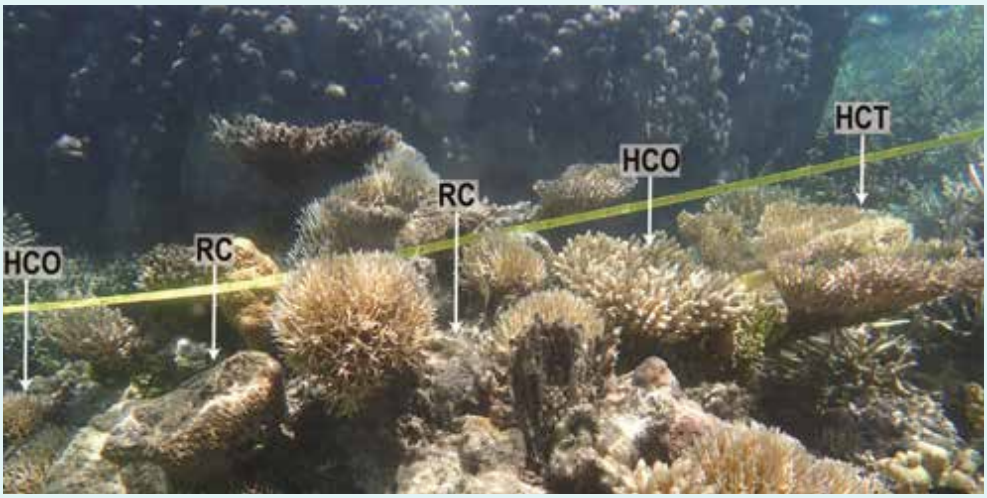
PROTOCOL

Point intercept transects (PITs) can be used to monitor broad-scale substrate composition to understand habitat status. This method involves identifying habitat that cross-sections the transect tape at set intervals. The habitat is identified according to standardised categories (see Appendix 6).

This method does not provide a good picture of habitat disturbances, such as crown-of-thorns abundance and bleached or diseased corals. These are better assessed through belt transects used to count fish and invertebrate abundance (see MS5) or quadrats for coral bleaching/disease (MS12).

This method may require well-trained, scuba-certified observers with specialised equipment. However, surveys are sometimes carried out using snorkelling equipment in shallow waters (<2m) and good surface conditions.

1. The site is located using a GPS unit and/or past knowledge of the location in relation to surrounding reef or island structures. On reaching the site, a weight attached to a surface float is deployed to mark the start of the survey; a GPS point is also recorded to mark this location.
2. The surveyors enter the water and secure the start of the transect tape. They record the date, the name of the site, the transect number, start time, visibility and name of the observer.
3. The surveyors swim in a straight line along the 100 m-transect tape. Habitat that cross-sections the transect tape every 50 cm is identified as per pre-defined categories (Appendix 6).
4. Once a transect is complete (40 points from 0 to 19.5 m), the surveyors swim along the transect tape until they reach the 25 m mark. They start recording habitats on the second transect, another 40 points from 25 to 44.5 m, then move to transect 3 from 50 to 69.5 m and finally transect 4, from 75 to 94.5 m. A single data sheet can be used for the four transects (Appendix 6). After completion of four transects, the surveyors ascend and exit the water.



CASE STUDY

PITs were widely used in the early 2000s for CBFM programmes, particularly through the Reef Check programme. The Pacific region has several sites recorded in the Reef Check Global Reef Tracker, available online, but most monitoring results have not been updated in the last 5–15 years.

New Caledonia is using PITs under its Coral Reef Observation Network across 34 sites spread across the country *(Réseau d'Observation des Récifs Coralliens 2023)*. The main objective of the network is to raise awareness on reef health through the involvement of local communities in monitoring. The monitoring sites are selected in consultation with local communities and contribute to assessing the effectiveness of CBFM. In the Drueulu community on the island of Lifou, Loyalty Islands, the monitoring started in 2020 in three sites, including a customary reserve established in 2019. A local youth fisher association was trained to do the monitoring and is currently involved in setting up a locally managed marine area beyond the existing customary reserve (S. Job, pers. comm. 2025).

In Vella la Vella, Western Province of Solomon Islands, the Sirubai community has been monitoring its marine protected area reefs since 2020 using PIT surveys and have witnessed a recovery of corals (J. Bukiri, pers. comm. 2025). The monitoring team leader, J. Bukiri, has recently trained 10 neighbouring communities to undertake monitoring using PITs. All data are recorded in a notebook and then analysed manually. These active PIT sites all benefit from some level of external support but the example from Solomon Islands shows that most of the process can be managed locally.

Tips to collect good data

This method can be used in combination with fish and invertebrate surveys (MS2) using the same transect tape. This means that fish and invertebrate survey data can be interpreted in the context of habitat status in addition to the influence of any CBFM rules.

When a new surveyor starts surveying, the first couple of transects can be conducted alongside an experienced surveyor. When the transects are complete, the two surveyors compare their results to ensure accuracy and consistency.

DATA STORAGE AND ANALYSIS

Data from one or two surveys can be stored in Excel or Google Sheets but larger amounts of data should be stored in databases. Some freely available databases exist for these types of data, such as Reef Cloud (Wyatt et al. 2022; http://reefcloud.ai/), SPC's Coastal Fisheries platform and MERMAID (https://datamermaid.org/). Some of these platforms conduct automatic data summaries for you.

Analysis requires converting the number of habitat types along a transect to a percentage. For example, if there were 20 observation points along the transect, and five of them were branching hard coral, the calculation to find the percentage cover of branching coral would be:

$$\frac{5}{20} \times 100 = 25\%$$

$$\frac{number\ of\ points\ of\ habitat\ type}{total\ number\ of\ points\ on\ transect} \times 100 = percentage\ cover\ of\ habitat\ type$$

This calculation is done for each transect or survey site, then an average is calculated for each survey station to track over time.



Method sheet 12

Quadrats

Programme monitoring | Monitoring habitats

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
12 Quadrats				Placing PVC quadrats at set intervals along a transect to estimate habitat cover, or taking photo quadrats at set intervals to quantify habitat cover using image processing software	Solomon Islands, FSM, RMI, CNMI

High score | Medium score | Low score

BASIC DESCRIPTION

Data collected	Substrate composition for any habitat type
Number of people required	Three: one boat captain if boat required to reach survey sites, two surveyors – one to lay the tape and another recording observations
Time	15 minutes per transect
Equipment	• Measuring tape • Quadrat made of PVC plastic, with holes drilled into it so that it sinks • Scuba or snorkelling equipment, protective clothing and footwear if walking on reef flats or seaweed beds at low tide • GPS to mark the site start and end points • Fish or invertebrate ID materials • Underwater camera in the case of photo-quadrats • Data sheet • Underwater slate • Pencil • Boat to access survey sites
Basic protocols	Quadrats are placed at regular intervals along a transect line. In each quadrat, habitat cover is assessed: either estimated in-water, or through analysing a photo after the survey.

PROTOCOL

Habitat/substrate composition can be monitored using quadrats. These are square frames of a set size, normally constructed using PVC piping. Holes drilled into the frames ensure the quadrats sink.

The use of this method may require scuba-certified observers with specialised equipment, but these surveys can sometimes be carried out using snorkelling equipment in shallow waters (<2 m) and good surface conditions. Methods can be simplified for use by community members.

1. The site is located using a GPS unit and/or past knowledge of the location in relation to surrounding reef or island structures. On reaching the site, a weight attached to a surface float is deployed to mark the start of the survey; a GPS point is also recorded to mark this location.
2. The surveyors enter the water and secure the start of the transect tape. They record the date, the name of the site, the transect number, start time, visibility and name of the observer.
3. If conducting photo quadrats, a photo of the survey slate is taken before beginning each transect.
4. One surveyor lays the tape, the other lays the quadrat at set intervals (SPC recommends every 2 m along a 40 m transect, but other intervals and transect lengths are used).
5. For each quadrat either:
   a. estimate and record the percentage cover of habitat types of interest, e.g. sea grapes, hard coral cover, seagrass or mangroves; or
   b. take a photo of the quadrat, ensuring that the entire quadrat is in the frame. This approach is used to quantify the percentage cover of more than two habitat types.
6. Once a transect is complete, any additional habitat or depth information is recorded, the survey tape is collected, and a new transect is begun, 5–10 m further on from where the first transect ended. After completion of six transects, the surveyors ascend and exit the water. A GPS point is recorded marking the end of the survey.

CASE STUDIES

In the Western Province, Solomon Islands, communities worked with WWF to sustainably manage seagrape harvests. They used quadrats of 50 cm x 50 cm placed every five m along 50 m long transects marked with tape measures. A total of six transects were laid out. Within the quadrats, surveyors estimated the percentage cover of sea grapes under the frame – for example, 40% sea grapes and 60% sand. This methodology was used to develop baseline coverage of seagrapes for each community before the project started. The baseline monitoring also identified the species of sea grapes found in that community, as well as the habitat it was growing in. The monitoring data was then discussed with communities to support their decisions around sea grape management. Following the introduction of management rules, the monitoring was repeated every six months to assess the changes in percentage cover of sea grapes over time (WWF Solomon Islands. Unpublished)

The countries of the Micronesia Challenge use photo quadrats to monitor habitats. Five 50-metre transects are laid down on the substrate and fifty photos are taken at one metre intervals along each transect line (Houk et al. 2015)

Tips to collect good data

To help with in-water estimation of habitat coverage inside 50 cm quadrats, a grid can be made with strings attached to the piping at 10 cm intervals. This results in 25 squares within the quadrat, each representing 4% cover.

Photo quadrats can be combined with fish or invertebrate surveys (MS2) along the same transect tape. This means that fish and invertebrate survey data can be interpreted in the context of habitat status in addition to the influence of any CBFM rules.

DATA STORAGE AND ANALYSIS

Photos can be taken of the quadrats for later processing if there is capacity to extract data from images following in-water surveys. This involves using tools such as CPCe (Kohler and Gill 2006) to mark randomly distributed points on the image, then identifying what lies below those points. Developments in the use of AI to identify habitat types from photos are facilitating data collection from images.

Whether extracted from images or estimated in-water, habitat data from one or two surveys can be stored in Excel or Google Sheets. Large amounts of data should be stored in databases. Some freely available databases exist for these data types, such as Reef Cloud, SPC's Coastal Fisheries platform, and Mermaid.

To analyse data, the percentage cover of each habitat type is calculated for each transect, then averaged out per survey site. These averages can be compared over time to understand the effects of fishing or management.



Monitoring socio-economic change

Socio-economic information can be used to understand the impacts of management on the lives of community members. The information collected can include demographics, resource use patterns, income, food security, and community empowerment or cohesion, to name a few.

This information should help identify the specific issues affecting the success or failure of management actions in achieving management objectives. In addition, the information can support decision-makers and community leaders to improve management or policy to minimise negative impacts on the community and to maximise the positive ones (Wongbusarakum and Pomeroy 2008).





Method sheet 13

Focus group discussion (socio-economics)

Monitoring conducted by the community

Monitoring the socio-economic impacts of fisheries management

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
13 Focus group discussion (socio-economics)				The management committee collects fishers' perceptions of the impact of management through focus groups or village meetings.	Widely conducted, but informally, without guidance questions

High score Medium score Low score

BASIC DESCRIPTION

Data collected	Changes to income and food from fishing
Number of people required	At least one
Time	10 minutes per fisher every three to six months
Equipment	Paper and pencil
External support for community monitoring	Minimal questionnaires or discussion points provided to the management committee.
Basic protocols	Convene fishing households to discuss changes to income or amount of marine food brought by their fishing activity.

PROTOCOL

1. Ideally, a member of the local management committee organises a meeting of a group of households that are heavily dependent on fishing for both income and food, including all community groups and a good representation of various fishing practices.
2. Discuss how management rules have affected food and income using the questions in Appendix 7.
3. In agreement with the group, tick the box that best represents the feedback from the fishers.
4. Take particular note if perceptions of the impact of management differ between different social groups or genders.
5. If the management committee cannot meet with fishers, another option is to report the answers to the questions through discussion within the management committee, but this has the risk of biasing results.

CASE STUDIES

Basic information can be collected by communities themselves to check if the management is bringing more food to the table or better income. Representatives of the local management committee can collect this information as part of existing local consultative processes. In Fiji for example, development committees in villages of Macuata and Ba Provinces consult and make decisions relating to the environment and other issues. These committees are also responsible for fisheries management plans, and the review of the associated action plans every two years (U. Malani, pers. comm. 2024). Similar consultation at village level has been reported by Conservation International in the Lau group, where socio-economic benefits from management related to the ability to meet community obligations and monetary improvement can be discussed during the monthly village meetings (S. Meo, pers. comm. 2024).

This is the most basic and likely widespread monitoring that is or should be happening in every community to keep people's attention on how the management is improving income and/or food security.

Tips to collect good data

The focus group discussion needs a good diversity of fishing households to give an accurate picture of the situation.

It is important to ensure that all participants are contributing to the discussion. If some participants are keeping quiet, they may be directly asked to share their situation. In other cases, separate discussions may be held with different groups, such as women and youth, or any other group it is considered important to hear from.

DATA STORAGE AND ANALYSIS

No analysis is necessarily needed during informal discussions. However, notes and key effects of CBFM could be kept in a notebook, keeping track of dates that feedback was given and of the participants. Pictures of the notebook page can be a good way to save the information. Alternatives to a notebook can be the Notes App of a cell phone, and a Word document in a computer. These documents should be saved in the Cloud, such as Google Drive or Dropbox, to keep the information safe if the smart phone is dropped in the sea or the computer crashes.



Method sheet 14

Interviews (socio-economics)

Programme monitoring

Monitoring the socio-economic impacts of fisheries management

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
14 Interviews (socio-economics)				Programme officers discuss with a management committee representative or with fishers to understand socio-economic impacts of CBFM.	

High score Medium score Low score

BASIC DESCRIPTION

Data collected	Impact of management on income, food availability, community cohesion or other socio-economic benefits
Number of people required	One at minimum but best with two people: one to ask questions and one to take notes
Time	20 minutes per interview
Equipment	Paper and pencil or computer
Basic protocols	Convene the management committee or have meetings with fishing households to discuss changes in income or food supply or any socio-economic benefits resulting from fisheries management.

PROTOCOL

1. Programme or fisheries officers organise a meeting with management committee representatives or fishers, for example at a landing site.
2. Discuss with a group or interview individuals on their perception of socio-economic impacts of CBFM using standardised questions. These questions can be found in Appendix 8.
3. Record answers to questions either on paper data sheets or using a tablet/phone with KoboCollect or alternative software.
4. These questions can be combined with those for other perception-based methods (MS3 and MS8), although it is recommended to keep the questionnaire short and focused.

CASE STUDIES

Fisheries officers or NGO staff can survey communities' perceptions on the impact of CBFM on their lives on a regular basis. The fisheries officers can find out what these perceptions are by administering a very simple questionnaire to a management committee representative. It is better if the management committee has already discussed some of these perceptions related to improved income or food with some community members prior to the visit by the fisheries officers. This questionnaire is adapted from the one developed for the Ministry of Fisheries in Tonga as part of their SMA strategy (Tonga Ministry of Fisheries 2025) and the questionnaire developed by the Fiji LMMA Network in 2009 (FLMMA 2009). In 2010–2011, the Fiji LMMA Network implemented the questionnaire across FLMMA sites to quickly assess the status of a site and highlight areas that could be improved. Results from 117 villages over four provinces showed that 51% of those villages had seen increased income from management (FLMMA 2012).

For a government, collecting the perceptions on management benefits is a simple and effective way to assess if management is meeting its objectives of improving livelihoods. It would also help identify communities where there are no benefits coming about from fisheries management.

Tips to collect good data

Conducting these interviews can be included in the routine of each fisheries officer when visiting a community or attending a community event.

Free, easy-to-use software is available to create electronic data collection forms that can be used in the field. For example, Kobo Toolbox is an open-source form-creation software. When paired with the app KoboCollect on a phone or tablet, it can be used to collect data offline.

DATA STORAGE AND ANALYSIS

Analysis should count the number of different responses per question in the case of quantitative results and disaggregate the data by sex and other social factors. Analyses of qualitative long-form responses require experience in coding and interpreting qualitative data.

Kobo Toolbox can create simple summary charts of responses to multiple choice questions.



Method sheet 15

Household surveys

Programme monitoring | **Monitoring the socio-economic impacts of fisheries management**

METHOD	COMPLEXITY*	COST	DATA QUALITY	DESCRIPTION	COVERAGE
15 Interviews (socio-economics)				Structured household surveys	Tonga, Micronesia, Samoa, American Samoa

High score | Medium score | Low score

BASIC DESCRIPTION

Data collected	Demographics, coastal and marine activities, threats to resources, socio-economic impacts of fisheries management
Number of people required	Two enumerators per household survey. If surveys cover large areas, multiple teams of enumerators would be needed.
Time	Interviews may take around 30 mins per household
Equipment	Paper surveys – printed copies of survey forms, pencils, erasers, clipboards to hold surveys, dry bags (to keep papers dry), field notebooks Digital surveys – tablets or smart phones with questionnaires loaded, access to electricity, dry bags (to keep tablets dry), back-up printed survey forms, field notebooks, pencils
Basic protocols	Highly structured household level survey with close-ended questions carried out in representative target communities (small, medium, large communities) selected through a sampling design. Representation of all community groups is essential, i.e. men, women, youth, elders, fishers, migrants, etc.

PROTOCOL

Detailed protocols can be found in the *Socio-economic Monitoring Guidelines for Coastal Managers in Pacific Island Countries* (Wongbusarakum and Pomeroy 2008). Suggested questions can be found in Appendix 9.

1. Sample design and list of target communities should be reviewed and discussed with relevant stakeholders who are familiar with the survey area.
2. The survey should be tested before implementation.
3. Where possible, community leaders should be notified before the visit. Upon arrival at the village, enumerators should meet with the community leaders before any surveys are conducted.
4. Visit households as per methods agreed and ask if some questions may be asked. Surveys must honour FPIC Principle – "free, prior and informed consent." Consent must be granted by each respondent before the start of the survey.

Questions are asked according to the questionnaire. When complete, thank participants for their time.

CASE STUDIES

Undertaking household surveys is a complex and costly process but provides useful information for governments and NGOs to adapt CBFM strategies.

Extensive socio-economic surveys have been implemented in several countries of the region, such as Palau, FSM, RMI, Tonga and American Samoa, to understand community perceptions of management effectiveness (e.g. Adjeroud et al. 2025). In Tonga, the Special Management Area survey undertaken in 2021 across 275 households showed that an important number of respondents who have been catching fish for their own consumption felt that they were consuming more seafood from their catch since the establishment of the SMA and, overall, there was overwhelming support across island groups for the potential of the SMA programme to provide fish and seafood for future generations. Weak enforcement of rules and regulations within the SMAs was, however, the biggest challenge identified by households (Tonga Ministry of Fisheries and Vava'u Environmental Protection Association 2021).

The socio-economic component of the National Coral Reef Monitoring Program (NCRMP) collects socio-economic data across all United States coral reef territories and jurisdictions to inform human connections indicators. In American Samoa, the baseline survey was conducted in 2014, and another survey was completed in 2021. The results show that most residents believed that the establishment of marine protected areas had led to a range of improved benefits for coral reefs and communities but the support for management strategies involving fishing bans, catch limits and fishing gear restrictions was low (Allen et al. 2023).

Tips to collect good data

Enumerators should carry a field notebook for extra notes. It is wise to capture any extra information that they may gather outside the survey, as this may help to explain any unusual data or trends.

If it is too busy at the survey location, request returning later to conduct the survey. If it is too noisy, request moving to a quieter place to conduct the survey.

At the end of each survey day, a debrief to discuss experiences and any challenges that may have arisen helps to improve the survey as it is carried out.

DATA STORAGE AND ANALYSIS

If using paper surveys, data will need to be transcribed into a programme such as Microsoft Excel or a database. The enumerator team leader or the survey coordinator will need to be responsible for quality control and review of the data once it is digitised.

If using data collection software (such as Kobo Toolbox, Google Forms, Survey Monkey), data will need to be saved or uploaded in areas with internet connection. When collecting data offline, it is important to use devices with enough storage capacity for the collected data. Survey forms that are comprised of only text require minimal storage capacity.

Simple counts of quantitative responses can be done for some questions. For qualitative, long-form answers, key themes will need to be extracted using coding software to best interpret data.

Using data for fisheries management

Interpreting monitoring results

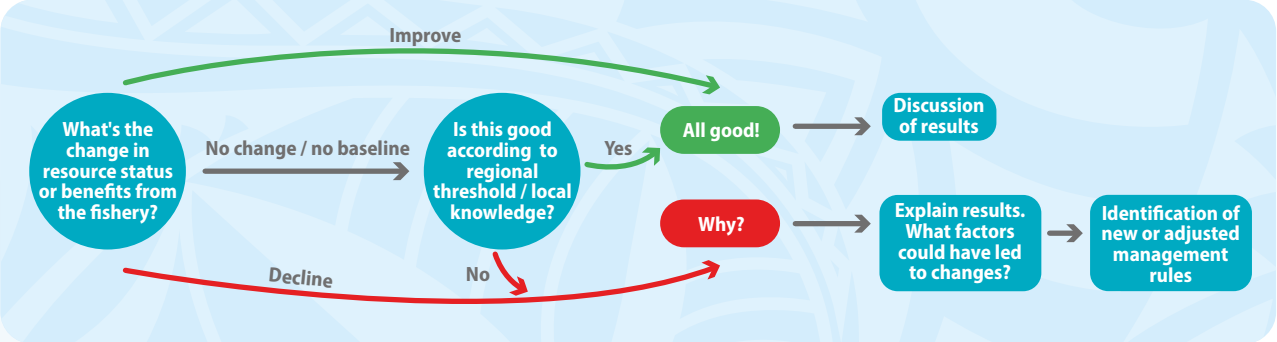
Interpreting data means telling a story or finding meaning in the numbers observed. To achieve this, data are summarised into clear, accessible formats that allow one to identify trends across time and space and compare results against baselines/control sites. Each method sheet of this guide includes simple suggestions to assist in analysing data.

As a reminder, CBFM does not tend to focus on maximising fisheries production. Instead, monitoring should assess whether management is achieving the objectives identified by communities and supporting programmes, such as maintaining or improving fisheries resources, food security, livelihoods, ecosystem health or other locally important outcomes (Govan et al. 2009; Jupiter et al. 2014). Where community, programme and national objectives differ, priority should be given to ensuring that community monitoring produces information useful for local management decisions.

This important distinction means that any decline – perceived or otherwise – in the status of fisheries should prompt community discussion on new or revised fisheries management rules. Conversely, if the resource status is steady or improving, and at a level that is acceptable according to community perceptions or regional thresholds, management adaptation may not be required. In these latter cases, ongoing monitoring and community engagement would still be necessary to understand the status of the resources and their benefits over time, and to ensure that the fisheries continue to be sustained.

This process for interpreting and using collected information can be summarised into a basic decision tree (Figure 3).

Figure 3: Decision tree to guide interpretation of results



Some examples of biological thresholds to assist in data interpretation are shown in Table 5. This table is not exhaustive and should be treated with caution; **local thresholds established through baseline or control surveys are always preferred to regional or global reference points.**

Table 5. Examples of biological thresholds to assist with interpretation of data where control sites or baselines do not exist

Category	Indicator		Threshold / reference point	Source
Fish in the water 	Density of species	*Rochia nilotica* (trochus)	500–600 ind. ha-1 on reef benthos transects is a healthy regional reference point.	Pakoa et al. (2014) provide regional thresholds of a variety of invertebrate species. Some are listed here. Only regional thresholds are displayed here. The community monitoring toolkits (Johnson et al. 2020) establish local thresholds for Solomon Islands, Marshall Islands, Vanuatu, Wallis & Futuna and French Polynesia for some invertebrates.
		Holothuria atra (lollyfish)	5,600 ind. ha-1 on reef benthos transects is a healthy regional reference point	
		Bohadschia argus (leopardfish)	120 ind. ha-1 on reef benthos transects is a healthy regional reference point.	
		Holothuria scabra (dandfish)	700 ind. ha-1 on soft benthos transects is a healthy regional reference point.	
		Tridacna maxima (giant clam)	750 ind. ha-1 on reef benthos transects is a healthy regional reference point.	
		Anadara spp. (mud clam)	2-5 shells m-2 is a healthy regional reference point.	
	Fish Biomass (multi-species)		~1000 kg/ha of fish biomass is seen as a "pristine" reef ecosystem across the globe. This is unlikely to be encountered in any CBFM context.	(MacNeil et al. 2015)
Catches 	Proportion of catch that are mature, or above the regulated size limit (Species-specific size at maturity needs to be established before one can use this indicator.)		100% is target, lower than this is cause for concern.	(Froese 2004), This approach is used in community monitoring toolkits (Johnson et al. 2020)
Habitat 	Proportion of coral cover		< 20% coral cover implies unhealthy reef ecosystem.	(Johnson et al. 2020; Vercelloni et al. 2020)

Discussions at the community-level to understand why changes are occurring could explore some of the questions below.

- What are the current fishing practices? Have there been any changes in how and where these species are fished? Have there been any changes in fishing gear? If yes, what do you think are the effects of this gear (nets, GPS, torches...)?
- Have you had any experience where habitats have been lost or damaged? Do you think losing these habitats or homes influences the health of fishing grounds?
- Is there good knowledge and buy-in with existing management rules?
- Have management rules been in place for long enough to cause changes?
- Drawing from traditional knowledge and science, are current management rules adapted to the biology and behaviour of species of concern?

The answers to these questions inform revisions to fisheries management. Management rules that are known to be used in CBFM in the Pacific region range from awareness raising, to periodic closures, and permanent no take-areas, amongst many others (Figure 4). Detailed guidance on how to facilitate community discussions and select the appropriate management tool is available in facilitation guides and associated CBFM booklets and flipcharts developed by cChange for several Pacific Island countries (see additional resources section for links). Further information on potential management options for CBFM can be found using the SPC series of information sheets for fishing communities (SPC 2018), a booklet entitled *Fish Smart Rules* (SPC 2023) and guidance produced by the LMMA Network (Govan et al. 2008).

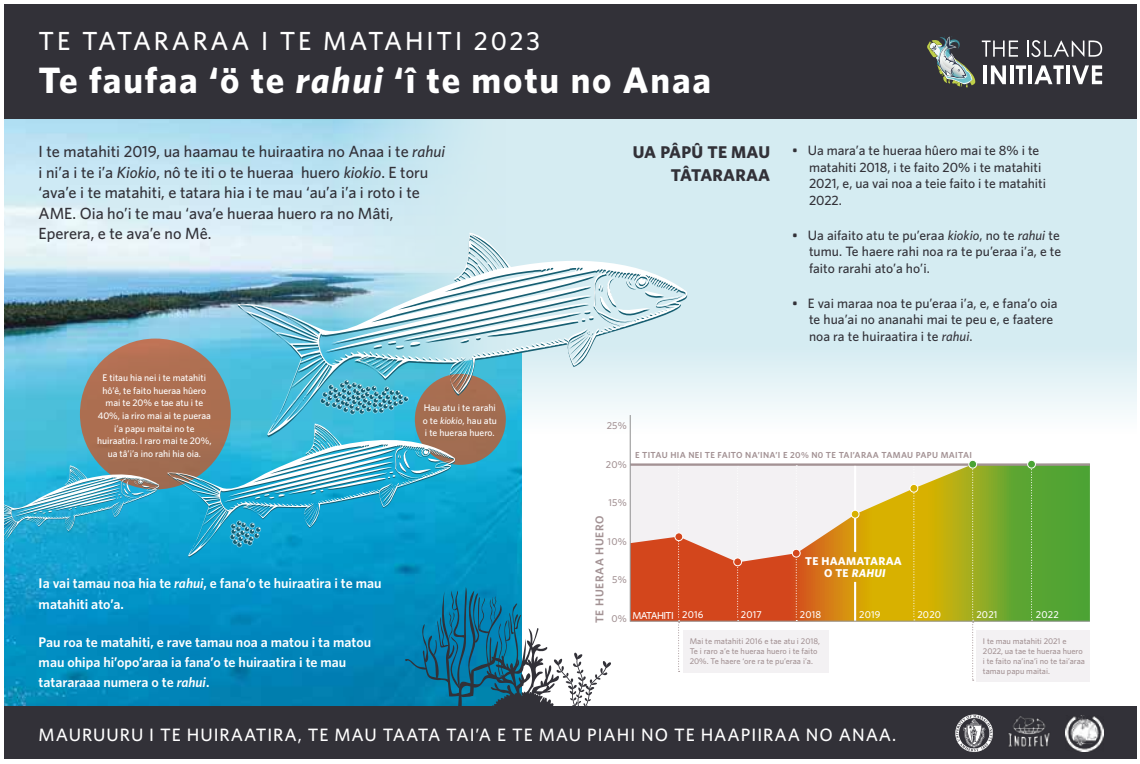
Figure 4. Examples of management measures that can be implemented as a part of CBFM



Case studies of data use in CBFM

To assist in understanding the process of interpreting data for management, some cases of how data have been brought together to inform CBFM decision-making are presented below. These case studies were sourced through literature searches, so are biased towards CBFM monitoring programmes that had some element of external support, instead of monitoring and management adaptation solely by a fishing community.

Bonefish (*Albula glossodonta*) in Anaa atoll, French Polynesia



Data used: Community perceptions of resource status from informal discussion (MS1, MS5), catch volumes and size of bonefish from catch monitoring (MS9).

What is the change? Catch data show that the population of bonefish was not at a healthy threshold – a spawning potential ratio of 7 to 11% between 2016 and 2018. This was supported by perceptions of resource status by elders in the community, who informally reported that bonefish have experienced significant declines, compared to historic abundance.

Explanation: The introduction of chicken wire to fish traps increased their efficiency in capturing and holding large numbers of fish during periods of high water.

Many fishing traps were abandoned, and corals were growing on them, creating a barrier that blocked bonefish migration to spawning grounds.

Management measures: Communication campaign through infographics on bonefish biology and recommendations for temporary closed seasons

Establishment of *rahui*, involving periodic closures of the fishery and deactivation of fish traps during this time

Sources: Filous, Lennox, Eric E.G. Clua, et al. 2019; Filous, Lennox, Eric E. G. Clua, et al. 2019; Filous et al. 2021

Mixed invertebrates and finfish fisheries across five communities in Vanuatu



Vanuatu Fisheries Department (2023)

Data used: Species length and abundance in catches collected through the *Ikasavea* application (MS9), which includes data about the fisher and fishing trips

Community perceptions of resource status and rule compliance through informal discussions during results feedback, and interviews built into catch monitoring with *Ikasavea* (MS9 and MS14)

What is the change? No baseline was available for catch data, so changes in catch composition and sizes over time could not be quantified. However, fishery characteristics were better understood. For example, catches were mostly dominated by wrasses (Labridae, 17% of overall catch by number) and emperors (Lethrinidae; 15%). Men reported harvesting from all accessible habitats, while women harvested from all habitats except the open ocean. A wide diversity of fishing gear was used.

At village level, perceptions from fishers in Takara (Efate Island, Vanuatu) highlighted declines in catch sizes of the Ambon Emperor (*Lethrinus amboinensis*). Catch data in Kwamera (Tanna Island, Vanuatu) showed high numbers of *Thalassoma purpurerum* (Surge Wrasse).

Explanation: There was no baseline or control site, so a trend was not available. However, improved understanding of fishery characteristics, in addition to perceived changes in catch, were useful in adapting and refining existing management rules. The cumulative data set across communities fed into national CBFM programme planning by national agencies.

Management responses: Monitoring data informed adjustments to management. Two adjustments are described below.

- In Takara: Community leaders proposed banning catches of Ambon Emperor (*Lethrinus amboinensis*) to protect it and similar Lethrinidae species, based on perceived declines in their sizes.
- In Kwamera: Evidence of abundant surge wrasse (*Thalassoma purpureum*) catches led to proposals for area and gear-based rule amendments to protect wrasses.

Source: Campbell et al. 2024

Finfishes in Ulithi atoll, Federated States of Micronesia



N. Crane 2023

Data used: Species length and abundance surveyed using in-water belt transects by scientists (MS4)

Habitat surveys conducted using quadrats by scientists (adapted version of MS11)

Species, length and abundance of fish caught, gear type and fishing grounds recorded by fishers in logbooks (MS7)

What is the change? The belt transects showed a decrease of in-water fish populations between 2019 and 2023 before and after COVID. Earlier monitoring had shown a significant increase in fish population after the first revised management plans were put in place in 2012. The catch logs provided a better understanding of the fisheries characteristics showing, for example, that 61% of the fish caught were herbivorous, and that spearfishing was involved in close to half of all landings. The monitoring associated with the catch logs was able to show where the fishing pressure was high and the effects on the habitats and fish populations.

Explanation: Sites sheltered from waves and wind near human settlements had lower fish biomass and degraded habitats in comparison to remote areas, due to their easier access. Remote areas were also fished but at a lower level; these sites did not show declines in resource status. In addition to the lower fishing level, fishing methods in remote areas were dominated by hook and line, whereas sites near settlements were dominated by fishers using spearguns and cast nets. Although line fishing targets a wider diversity of fish, spearguns and cast nets target mostly herbivorous fish, leading to a greater impact on habitats due to the role herbivores play in maintaining healthy reefs.

Management response: The fuel provided to the communities for their involvement in filling in the catch logs is being used by fishers to fish further away from their usual fishing grounds to allow for their recovery. Because the monitoring data collected in 2013–2014 showed that most species were caught with spearguns, there was a reduction in the use of spearguns in 2014 and 2015 and an increase in using hook and line. Some villages have also introduced a ban on spearfishing at night to limit the impact of fishing on herbivores, especially parrotfishes.

Source: Crane et al. 2017

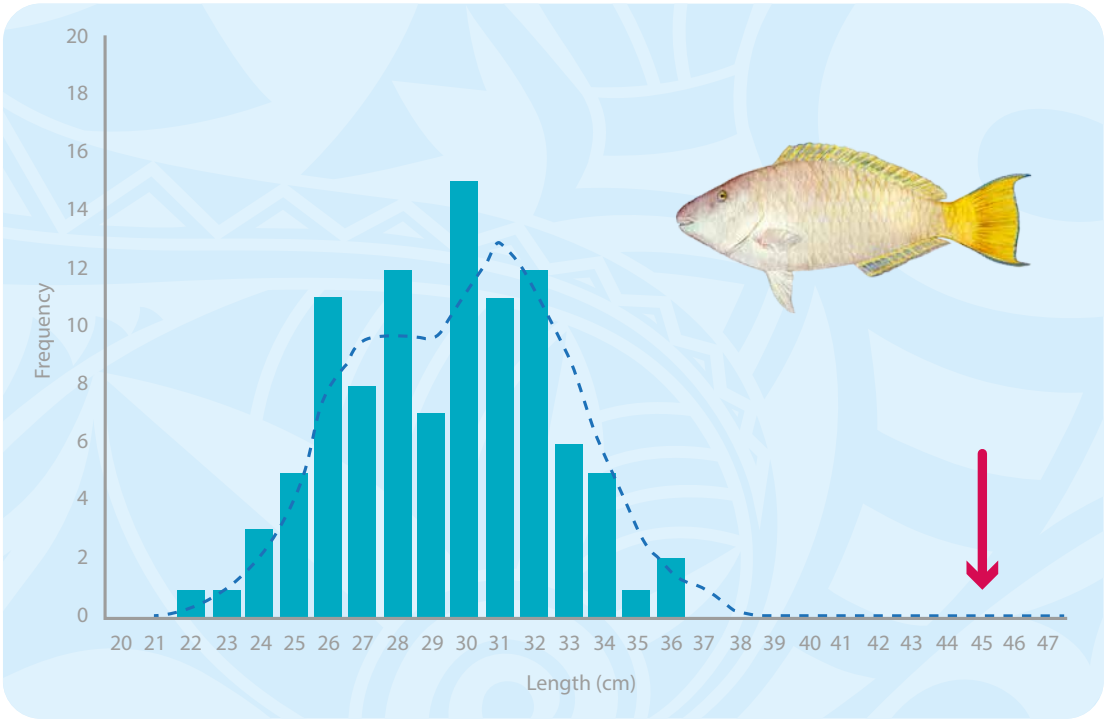
Pacific longnose parrotfish (Ulavi), Macuata Province, Fiji

Data used: Lengths of 100 Ulavi (Hipposcarus longiceps) were recorded by fishers over one month of sampling (MS6)

What is the change? There was no baseline, but the length of fish were compared to a locally established reference point named the Set Size. The Set Size for Ulavi in Fiji is 45 cm; catching fish over this size ensures that fish have reached sexual maturity and have had the chance to reproduce. Fishers were provided with a traffic light grading system as follows: If more than 50% of fishes caught are equal to or above the Set Size, the fishery is likely to be sustainable (green); if between 10 and 50% of the fishes caught are equal to or above the Set Size, the fishery may not be sustainable and management rules should be implemented (orange); and if less than 10% of fishes caught are equal or above Set Size, the fishery is in danger (red) and urgent management action is required.

Figure 5 presents the distribution of sizes recorded for the 100 fish caught and measured during the monitoring campaign led by the fishers. It shows that none of the fish exceed the set size and that urgent management action is required.

Figure 5. Ulavi (*Hipposcarus longiceps*) length distribution of 100 fish caught over one month with the red arrow showing the set size (45 cm) for this species in Fiji



Explanation: The most common fishing methods for parrotfishes in Fiji are gillnets and spearfishing. Many ulavi are caught in gillnets when they gather in spawning aggregations. Fishing in this way removes the breeding population, leaving few fish that can spawn and replace the fished population. Night spearfishing also targets parrotfish when they are at rest and easy to catch. The low effort required to capture this species could have also led to overfishing, resulting in smaller fish.

Management response: A range of management recommendations was presented to the community (who remain unnamed to protect their privacy). The community decided to implement a phased approach over three years. In the first year, implement a fishing ban for ulavi; in the second year, a ban on night spearfishing of all parrotfish; and in the third year, assuming the fish have recovered, allow only fish that have reached the set size for consumption or sale to be caught.

Source: CChange 2026

Data communications and sharing

Discussion and communication of monitoring results with community stakeholders played an important role in all the above case studies. The key to sustaining monitoring over the long term is ensuring that data are available to, and used by, community stakeholders to put in place or improve management. This needs to happen, whether monitoring is conducted by community members, governments or NGOs.

Before working on communicating any monitoring results, consent should be obtained from those who own the data. In the case of CBFM, most data belong to the local communities, so their informed consent is required before any information is shared publicly outside their own community.

As a programme officer, dissemination of the results for community use can be done in a variety of ways; the process should include the steps described below.

- **Identify the target audiences**
  Key target audiences include fishers (men, women, youth, children), traditional chiefs, community leaders and coastal community fisheries management committees. In addition, champions or networks, such as faith-based organisations, women's groups, or other community networks, can help to reach key audiences.
- **Write some key messages**
  Before communicating the results, the data collection programme needs to be explained – why the data are collected and what benefits this provides to audiences. When sharing the results of the monitoring, the top three findings will be the most useful for audiences. Where possible, these findings need to be linked to the management objectives agreed on by the local communities.
- **Select the tactics to distribute the information**
  Commonly used ways to share information in CBFM contexts include social media, radio programmes, posters in public spaces, extensive distribution of fliers and village meetings (Radway 2026).

Radio and social media are good ways to reach a wide audience at a low cost. For example, a radio show could be used to explain the monitoring programme and the main results. Social media platforms can also be used to share key findings, such as the health of the stock of key species.

In addition, the village meeting is a good way to share tailored information, as it is an opportunity for the community to provide feedback on the results, discuss possible reasons for any changes, and the adjustment or implementation of management measures if needed (Worldfish and University of Wollongong 2021).



Figure 6. Example of a social media post in Wallis (programme monitoring using «advanced catch monitoring»; MS9)

Produce your information tools to share your results

To share results, make the key messages easy to understand. Use visuals such as maps, graphs, or icons to show meaning. Colours and icon sizes can highlight differences.

Resources are available to guide the communication of monitoring results for decision-making. For example, the C2O Pacific Toolkits have template reporting posters (Figure 7; Johnson et al. 2023) and the Blue Ventures toolkit on community engagement with data (Freed et al. 2021) give general guidance on how to share and discuss the results of a fisheries monitoring programme. Furthermore, there are many examples of how fisheries information has been shared outside CBFM contexts (Figure 8).

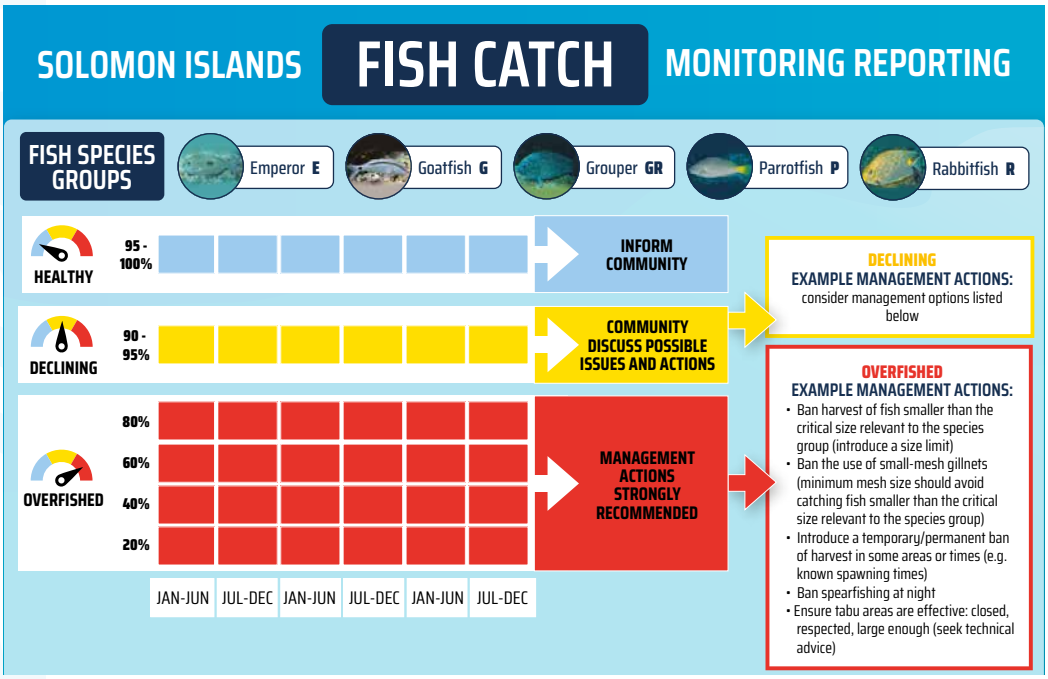


Figure 7: Example of a reporting poster included in the C2O Pacific Toolkit that used data from basic catch monitoring; MS6 (Johnson et al. 2023).

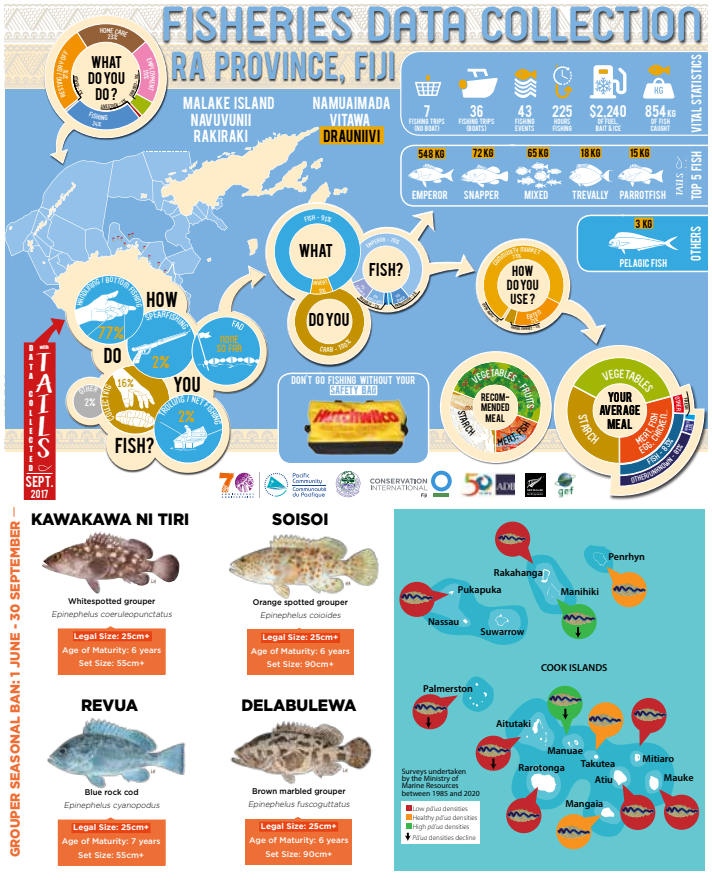


Figure 8. Examples of products communicating results of national fisheries monitoring programmes.

1 - © SPC
2 - © cChange
3 - © SPC

Additional resources

Echoes of oceania (CBFM online portal)

Catch monitoring manual for CBFM in the Pacific region. Manual 1: Technical manual for data collectors

Catch monitoring manual for CBFM in the Pacific region. Manual 2: Training workshop manual

Catch monitoring manual for CBFM in the Pacific region. Manual 3: Data management for data coordinators

Vanuatu, C2O community marine monitoring toolkit pp 20–22 (Johnson et al. 2018);

Solomon Islands, C2O community marine monitoring toolkit pp 63–64 (Johnson et al. 2023);

RMI C2O community marine monitoring toolkit pp 15 (Johnson et al. 2021);

Wallis and Futuna, C2O community marine monitoring toolkit, pp7 (Johnson et al. 2023);

French Polynesia, C2O community marine monitoring toolkit, pp 8 (Johnson et al. 2025)

Reefs and fisheries monitoring handbook for the Ulithi Atoll and Yap Outer Islands (Cannon et al.)

4FJ Official rules (cChange 2022)

Link to monitoring techniques video (French)

https://lmmanetwork.org/wp-content/uploads/2021/08/Govan-et-al-2008-LMMA-CBAM-Guide.pdf

Facilitator's guide: the local guide to better catches, cChange 2024.

The local guide to better catches (Booklet), cChange, 2024.

The local guide to better catches (Flipchart), cChange, 2024.

Note: similar cChange guides have been produced for Papua New Guinea, Vanuatu, Fiji, Tonga and the Federated States of Micronesia and are all available on Echoes of Oceania.

References

Adjeroud M., Allen M., Alling A., Almany J., Argyle P., Bonin M., Booth J., Boslogo T., Brown V., Cannon S., et al. 2025. Status and Trends of Coral Reefs of the Pacific: 1980 - 2023. Wicquart J., Towle E.K., Dallison T., Staub F., Planes S., editors. Global coral reef monitoring network (GCRMN) and International Coral Reef Initiative (ICRI).

Albert S., Tawake A., Vave R., Fisher P., Grinham A. 2016. Indicators of herbivorous fish biomass in community-based marine management areas in Fiji. Pacific Conservation Biology. 22(1):20. https://www.researchgate.net/publication/297598410_Indicators_of_herbivorous_fish_biomass_in_community-based_marine_management_areas_in_Fiji

Allen M., Fleming C., Alva A., Gonyo S., Regan S., Towele E. 2023. National coral reef monitoring program socioeconomic monitoring component : Summary findings for American Samoa, 2021. https://doi.org/10.25923/2NFT-YG95

Andrew N., Campbell B., Delisle A., Li O., Neihapi P., Nikiari B., Sami A., Steenbergen D., Uriam T. 2020. Developing participatory monitoring of community fisheries in Kiribati and Vanuatu.

Campbell B., Steenbergen D., Li O., Sami A., Nikiari B., Delisle A., Neihapi P., Uriam T., Andrew N. 2024. Characterising a diversity of coastal community fisheries in Kiribati and Vanuatu. Fish and Fisheries. 25(5):837–857. https://doi.org/10.1111/faf.12849

cChange 2026. Mataniwa Ulavi Status Report. Fiji

Cochrane K.L., Andrew N.L., Parma A.M. 2011. Primary fisheries management: a minimum requirement for provision of sustainable human benefits in small-scale fisheries: Primary management of small-scale fisheries. Fish and Fisheries. 12(3):275–288. https://doi.org/10.1111/j.1467-2979.2010.00392.x

Crane N.L., Nelson P., Abelson A., Precoda K., Rulmal J., Bernardi G., Paddack M. 2017. Atoll-scale patterns in coral reef community structure: Human signatures on Ulithi Atoll, Micronesia. Patterson HM, editor. PLOS ONE. 12(5):e0177083. https://doi.org/10.1371/journal.pone.0177083

Da Silva I.M., Hill N., Shimadzu H., Soares A.M.V.M., Dornelas M. 2015. Spillover effects of a community-managed marine reserve. Tsikliras AC, editor. PLOS ONE. 10(4):e0111774. https://doi.org/10.1371/journal.pone.0111774

Di Lorenzo M., Guidetti P., Di Franco A., Calò A., Claudet J. 2020. Assessing spillover from marine protected areas and its drivers: A meta-analytical approach. Fish and Fisheries. 21(5):906–915. https://doi.org/10.1111/faf.12469

English S.A., Wilkinson C., Baker V., Australian Institute of Marine Science, editors. 1997. Survey manual for tropical marine resources. 2. ed. Townsville: Australian Institute of Marine Science.

Filous A., Lennox R.J., Beaury J.P., Bagnis H., Mchugh M., Friedlander A.M., Clua E.E.G., Cooke S.J., Fuller T.K., Danylchuk A.J. 2021. Fisheries science and marine education catalyze the renaissance of traditional management (*rahui*) to improve an artisanal fishery in French Polynesia. Marine Policy. 123:104291. https://doi.org/10.1016/j.marpol.2020.104291

Filous A., Lennox R.J., Clua E.E.G., Cooke S.J., Danylchuk A.J. 2019. Length-based assessment of an artisanal albulid fishery in the south pacific: a data-limited approach for management and conservation. Marine and Coastal Fisheries. 11(6):519–534. https://doi.org/10.1002/mcf2.10097

Filous A., Lennox R.J., Clua E.E.G., Danylchuk A.J. 2019. Fisheries selectivity and annual exploitation of the principal species harvested in a data-limited artisanal fishery at a remote atoll in French Polynesia. Ocean & Coastal Management. 178:104818. https://doi.org/10.1016/j.ocecoaman.2019.104818

Fisk D. 2007. Niue sustainable coastal fisheries pilot project: Community-based monitoring. SPREP.

FLMMA. 2009. FLMMA strategic planning meeting, community monitoring session. Colo-i-Suva, Fiji.

FLMMA. 2012. FLMMA Preliminary site audit results. Fiji.

Ford-Learner N., Gordon S., Smallhorn-West P., Afu S., Aisea L., Fatongiatu V., Hanisi L., Kioa S., Lokotui S., Ma'u Fatiaki K., et al. 2024. Status of monitoring and evaluation of Tonga's Special Management Area program. Lymbery A, editor. Pacific Conservation Biology. 30(5). https://doi.org/10.1071/PC24003

Freed S., Oates J., Vessaz E., Chapman J., Gilchrist H., Hakim L., House J., Macdonald M., Slade. 2021. Community Engagement with Data: A practitioner's guide and toolkit for using data in community based marine management. Bristol, United Kingdom: Blue Ventures.

Froese R. 2004. Keep it simple: three indicators to deal with overfishing. Fish and Fisheries. 5(1):86–91. https://doi.org/10.1111/j.1467-2979.2004.00144.x

Govan H., Aalbersberg W., Tawake A., Parks. 2008. Locally-managed marine areas: A guide for practitioners. LMMA Network.

Govan H., Comley J., Tan W., Guilbeaux M., Vave R. 2011. Recommendations from ten years of monitoring under the LMMA network's learning framework. LMMA Network.

Govan H., Lalavanua W. 2022. Status of community-based fisheries management in Pacific Islands countries and territories: survey report. Noumea, New Caledonia: Secretariat of the Pacific Community.

Govan H., Lalavanua W., Steenbergen D.J. 2024. Coastal fisheries governance in the pacific islands: the evolution of policy and the progress of management-at-scale. In: Nakamura J, Chuenpagdee R., Jentoft S., editors. Implementation of the Small-Scale Fisheries Guidelines. Vol. 28. Cham: Springer Nature Switzerland. (MARE Publication Series). p. 207–240.

Gulland J.A., Rosenberg A.A. 1992. A review of length-based approaches to assessing fish stocks. Rome: Food and Agriculture Organization of the United Nations (FAO fisheries technical paper).

Houk P., Camacho R., Johnson S., McLean M., Maxin S., Anson J., Joseph E., Nedlic O., Luckymis M., Adams K., et al. 2015. The Micronesia challenge: assessing the relative contribution of stressors on coral reefs to facilitate science-to-management feedback. Bernardi G., editor. PLOS ONE. 10(6):e0130823. https://doi.org/10.1371/journal.pone.0130823

Job S. Unpublished. "Atlas of Communal Biodiversity" (i.e ABC) project developed for the Loyalty Islands of New Caledonia and funded by the French office for Biodiversity.

Johannes R.E. 1978. Traditional Marine Conservation Methods in Oceania and Their Demise. Annual Review of Ecology and Systematics. 9(1):349–364. https://doi.org/10.1146/annurev.es.09.110178.002025

Johannes R.E. 1998. The case for data-less marine resource management: examples from tropical nearshore finfisheries. Trends in Ecology & Evolution. 13(6):243–246. https://doi.org/10.1016/S0169-5347(98)01384-6

Johnson J., Welch D., Hooper E., Edney G., Waterhouse J., Kaltavara J. 2018. Community Marine Monitoring Toolkit: A locally-developed toolkit to inform community-based management of marine resources in Vanuatu.

Johnson J., Welch David J., Kalsaria T., Ake A. 2024. Review of the Pacific Community Marine Monitoring Toolkit to support community-based resource management. Port Vila, Vanuatu: C2O Pacific.

Johnson J.E., Hooper E., Welch D.J. 2020. Community Marine Monitoring Toolkit: A tool developed in the Pacific to inform community-based marine resource management. Marine Pollution Bulletin. 159:111498. https://doi.org/10.1016/j.marpolbul.2020.111498

Johnson J.E., Welch D.J., Pineda M.-C., Hughes A., Jupiter S., Howard R. 2023. Solomon Islands community marine monitoring toolkit: a facilitators guide. C2O Pacific and Wildlife Conservation Society.

Johnson J.E., Welch D.J. 2024. Guide de terrain pour la mise en œuvre d'un suivi local pour une meilleure gestion. Polynésie Française: C2O et Direction des Ressources Marines de Polynésie française.

Johnson J.E., Welch D.J. 2025. Boîte à outils pour le suivi communautaire du milieu marin de Polynésie française: guide de terrain. Polynésie Française: C2O Pacific et Direction des Ressources Marines Polynésie Française.

Johnson J.E., Welch D.J., Kabua-Tibon E., Yamamura B., Edwards F. 2021. Marshall Islands community marine monitoring toolkit: a facilitators guide. Majuro, Marshall Islands: C2O Pacific and Marshall Islands Marine Resources Authority.

Jupiter S.D., Cohen P.J., Weeks R., Tawake A., Govan H. 2014. Locally-managed marine areas: multiple objectives and diverse strategies. Pacific Conservation Biology. 20(2):165. https://doi.org/10.1071/PC140165

King M., Fa'asili U., Fakahau S., Vunisea A. 2003. Strategic plan for fisheries management and sustainable coastal fisheries in Pacific Islands. Noumea, New Caledonia: Secretariat of the Pacific Community.

Kohler K.E., Gill S.M. 2006. Coral Point Count with Excel extensions (CPCe): A Visual Basic program for the determination of coral and substrate coverage using random point count methodology. Computers & Geosciences. 32(9):1259–1269. https://doi.org/10.1016/j.cageo.2005.11.009

LMMA Network. 2003. Learning Framework for the Locally Managed Marine Area Network. Suva, Fiji.

MacNeil M.A., Graham N.A.J., Cinner J.E., Wilson S.K., Williams I.D., Maina J., Newman S., Friedlander A.M., Jupiter S., Polunin N.V.C., et al. 2015. Recovery potential of the world's coral reef fishes. Nature. 520(7547):341–344. https://doi.org/10.1038/nature14358

Margoluis R., Salafsky N., editors. 2010. Measures of success: designing, managing, and monitoring conservation and development projects. Washington, D.C: Island Press.

McClanahan T.R., Graham N.A.J., MacNeil M.A., Muthiga N.A., Cinner J.E., Bruggemann J.H., Wilson S.K. 2011. Critical thresholds and tangible targets for ecosystem-based management of coral reef fisheries. Proceedings of the National Academy of Sciences. 108(41):17230–17233. https://doi.org/10.1073/pnas.1106861108

Miller K.I., Russ G.R. 2014. Studies of no-take marine reserves: Methods for differentiating reserve and habitat effects. Ocean & Coastal Management. 96:51–60. https://doi.org/10.1016/j.ocecoaman.2014.05.003

Ministry of Fisheries Fiji. 2022. Official Rules: Legal sizes, set sizes & banned marine species in Fiji.

Pakoa K., Friedman K.J., Moore B., Tardy E., Bertram I. 2014. Assessing tropical marine invertebrates: a manual for Pacific Island resource managers. Pacific Community (SPC).

Pauly D., Christensen V., Dalsgaard J., Froese R., Torres F. 1998. Fishing down marine food webs. Science. 279(5352):860–863. https://doi.org/10.1126/science.279.5352.860

Prince J. 2017. Informing community-based fisheries management with spawning potential surveys. SPC Fisheries Newsletter. 154.

Prince J., Creech S., Madduppa H., Hordyk A. 2020. Length based assessment of spawning potential ratio in data-poor fisheries for blue swimming crab (*Portunus* spp.) in Sri Lanka and Indonesia: Implications for sustainable management. Regional Studies in Marine Science. 36:101309. https://doi.org/10.1016/j.rsma.2020.101309

Radway S. 2026. How to build a national information strategy for scaling up community-based fisheries management.

Réseau d'Observation des Récifs Coralliens. 2023. Les récifs corallien de Nouvelle-Calédonie; 25 ans d'observation. RORC Nouvelle-Calédonie.

Rochet M.-J., Prigent M, Bertrand J.A., Carpentier A., Coppin F., Delpech J.-P., Fontenelle G., Foucher E., Mahé K., Rostiaux E., et al. 2008. Ecosystem trends: evidence for agreement between fishers' perceptions and scientific information. ICES Journal of Marine Science. 65(6):1057–1068. https://doi.org/10.1093/icesjms/fsn062

Ruano-Chamorro C., Subida M.D., Fernández M. 2017. Fishers' perception: An alternative source of information to assess the data-poor benthic small-scale artisanal fisheries of central Chile. Ocean & Coastal Management. 146:67–76. https://doi.org/10.1016/j.ocecoaman.2017.06.007

Samoilys M.A., Carlos G. 2000. Determining methods of underwater visual census for estimating the abundance of coral reef fishes. Environmental Biology of Fishes. 57(3):289–304. https://doi.org/10.1023/A:1007679109359

Shedrawi G., Magron F., Vigga B., Bosserelle P., Gislard S., Halford A.R., Tiitii S., Fepuleai F., Molai C., Rota M., et al. 2024. Leveraging deep learning and computer vision technologies to enhance management of coastal fisheries in the Pacific region. Scientific Reports. 14(1):20915. https://doi.org/10.1038/s41598-024-71763-y

Smallhorn-West P., Gordon S., Stone K., Ceccarelli D., Malimali S., Halafihi T., Wyatt M., Bridge T., Pressey R., Jones G. 2020. Biophysical and anthropogenic influences on the status of Tonga's coral reefs and reef fish fishery. Ferse SCA, editor. PLOS ONE. 15(11):e0241146. https://doi.org/10.1371/journal.pone.0241146

SPC (The Pacific Community). 2015. SciCOFish Final Report 2010-2015. Noumea, New Caledonia: The Pacific Community.

SPC (The Pacific Community). 2018. Guide and information sheets for fishing communities. Noumea, New Caledonia.

SPC (The Pacific Community). 2019. RTMCF3 Outcomes and Agreed Action Plan. Noumea, New Caledonia.

SPC (The Pacific Community). 2021a. Pacific Framework for Action on Scaling up Community-based Fisheries Management: 2021–2030. Noumea, New Caledonia.

SPC (The Pacific Community). 2021b. Outcomes and actions report from the 4th spc regional technical meeting on coastal fisheries and aquaculture. Noumea, New Caledonia.

SPC (The Pacific Community). 2022. Outcomes and actions report from the 5th spc regional technical meeting on coastal fisheries and aquaculture. Noumea, New Caledonia.

SPC (The Pacific Community). 2023. Fish smart rules: tips and tools for community-based fisheries management practitioners to revive fishing grounds.

Steenbergen D., Sami A., Nikiari B., Magron F., Vigga B., Li O., Shedrawi G., Obregon C., Delisle A., Neihapi P., et al. 2024. Monitoring community fisheries: Exploring utility of automated monitoring to support adaptive management. SPC Fisheries Newsletter. 173:34–50.

Tonga Ministry of Fisheries. 2025. Tonga Special Management Area Strategy: 2025–2030.

Tonga Ministry of Fisheries (MoF), Vava'u Environmental Protection Association (VEPA). 2021. Household survey of Special Management Area communities in Tonga: Assessment for the monitoring and evaluation of the SMA programme. Tonga.

Tonga Ministry of Fisheries, Vava'u Environmental Protection Association. 2016. Household survey of special management area communities in Tonga: assessment for the monitoring and evaluation of the SMA programme.

University of Wollongong. 2023a. Catch monitoring manual for CBFM in the Pacific region. Manual 1: Technical manual for data collectors. Australia: Australian National Centre for Ocean Resources and Security, University of Wollongong Report No.: 1.2.

University of Wollongong. 2023b. Catch Monitoring Manual for CBFM in the Pacific Region. Manual 2: Training Workshop Manual. Australia: Australian national centre for ocean resources and security, University of Wollongong Report No.: 1.2.

University of Wollongong. 2023c. Catch Monitoring Manual for CBFM in the Pacific Region. Manual 3: Data management for data coordinators. Australia: Australian national centre for ocean resources and security, University of Wollongong Report No.: 1.2.

Vercelloni J, Caley MJ, Mengersen KL. 2020. Thresholds of coral cover that support coral reef biodiversity. In: Mengersen KL, Pudlo P, Robert CP, editors. Case studies in applied bayesian data science. Vol. 2259. Cham: Springer International Publishing. (Lecture Notes in Mathematics). p. 385–398.

Wencélius J. 2022. Recensement des pêcheurs de Punaauia et étude de leurs pratiques de pêche, de leurs perceptions des ZPR et de leurs recommandations en termes de gestion. Papeete, Polynésie Française.

Wicquart J., Towle E.K., Dallison T., Staub F., Planes S., Adjeroud M., Allen M., Alling A., Almany J., Argyle P., et al. 2025. Status and trends of coral reefs of the Pacific: 1980 - 2023. Global Coral Reef Monitoring Network (GCRMN) and International Coral Reef Initiative (ICRI).

Wilson J., Green A. 2009. Biological monitoring methods for assessing coral reef health and management effectiveness of marine protected areas in Indonesia. Bali, Indonesia: The Nature Conservancy.

Wongbusarakum S., Pomeroy RS. 2008. SEM-Pasifika; Socio-economic monitoring guidelines for coastal managers in Pacific Island countries.

Worldfish, University of Wollongong. 2021. Community-based fisheries management plan reviews – facilitation guide. Noumea, New Caledonia: Pacific Community.

WWF Solomon Islands. Unpublished. Seaweed monitoring results in Saeragi, Boboe, Kongulavata; Western Province. Western Province, Solomon Islands: World Wildlife Foundation.

Wyatt M., Radford B., Callow N., Bennamoun M., Hickey S. 2022. Using ensemble methods to improve the robustness of deep learning for image classification in marine environments. Methods in Ecology and Evolution. 13(6):1317–1328. https://doi.org/10.1111/2041-210X.13841

Zamborain-Mason J., Connolly S.R., MacNeil M.A., Barnes M.L., Bauman A.G., Feary D.A., Huertas V., Januchowski-Hartley F.A., Lau J.D., Mihalitsis M., et al. 2025. Downscaling global reference points to assess the sustainability of local fisheries. Conservation Biology. 39(3):e14440. https://doi.org/10.1111/cobi.14440

Appendices

Appendix 1: Suggested questions and data sheet for Method Sheet 1 and 3

Communities or programme staff monitoring fish and invertebrates in their environment through focus group discussions.

Q#	QUESTIONS	RESPONSES
1	Has the number of fish in your fishing ground changed since the establishment of rules/since you last reported it?	☐ Increased ☐ Decreased ☐ No change
2	Has the number of invertebrates in your fishing ground changed since the establishment of rules/since you last reported it?	☐ Increased ☐ Decreased ☐ No change
3	Have the size of fish in your fishing grounds changed since the establishment of the rules/since you last reported it?	☐ Increased ☐ Decreased ☐ No change
4	Have the size of invertebrates in your fishing grounds changed since the establishment of the rules/since you last reported it?	☐ Increased ☐ Decreased ☐ No change
5	Has the village observed a return of fish and/or invertebrates that had disappeared? If yes: describe which fish or invertebrate?	☐ Yes ☐ No

Appendix 2: Data sheet for Methods Sheet 2

Communities monitoring fish and invertebrates in their environment using belt transects

Monitor	John	**Date**	14/10/2023	
Site name	Breakpoint	**Time**	9 a.m.	
Transect 1				
Fish	**Size Class 1**	**Size Class 2**	**Size Class 2**	**Size Class 4**
Surgeon	II	I		
Grouper			II	II
…		II		
Transect 2				
Surgeon				
Grouper				
…				

Appendix 3: Data sheet for Methods Sheet 4

Programme staff monitoring fish or invertebrates in their environment using belt transects

Date	**Reef fish monitoring**				Transect length/width		
Start time		Site		Transect n°		Tide	
Depth		GPS		Visibility		Observer	
Fish	**Size categories (cm)**						
	5 to 10	**11 to 15**	**16 to 20**	**21 to 25**	**26 to 30**	**31 to 35**	**36 to 40**	**>40**

Data recording sheet adapted from AIMS, 2018

Date	**Invertebrate monitoring**				Transect length/width		
Start time		Site		Transect		Tide	
Depth		GPS		Visibility		Observer	
Invertebrate	**Sizes of each specimen in cm***						

** A stick can be marked for each specimen recorded if sizes cannot be measured.*

Appendix 4: Suggested questions and data sheet for Methods Sheets 5 and 8

Communities or programme officers monitoring fish or invertebrate catches using focus group discussion or interviews.

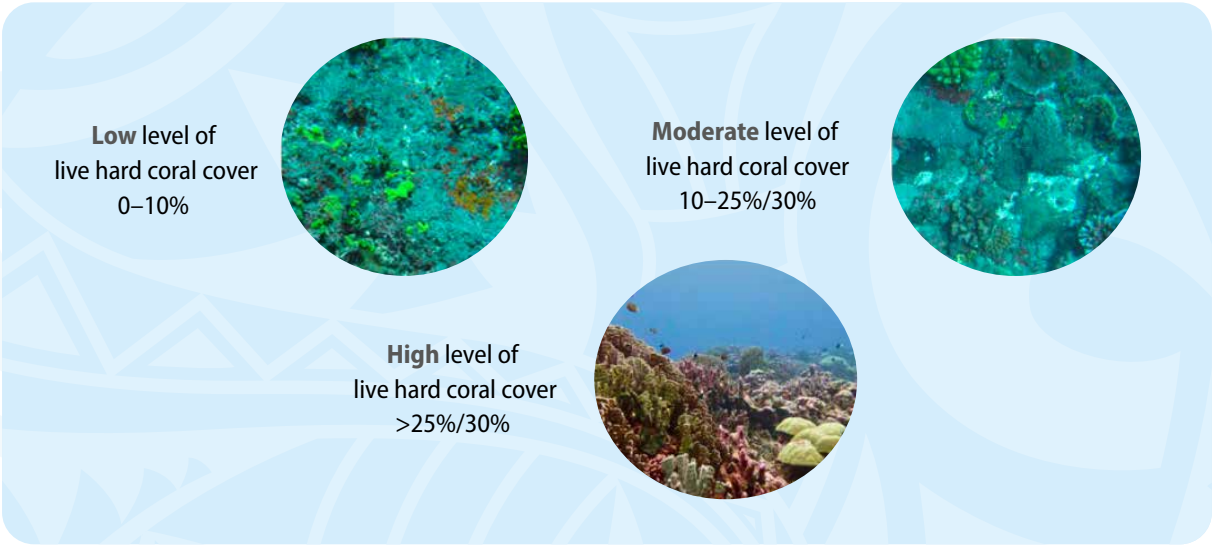
FISH	What are your 3 most important species ? (Local or species name)	What is the gear used to catch/harvest?	What changes noticed in the overall catch rate during the past 3 months?	
	1.		☐ 5 (Improving a lot) ☐ 4 (Improving a little) ☐ 3 (The same / stable) ☐ 2 (Declining a little) ☐ 1 (Declining a lot)	
	2.		☐ 5 ☐ 4 ☐ 3	☐ 2 ☐ 1
	3.		☐ 5 ☐ 4 ☐ 3	☐ 2 ☐ 1
INVERTEBRATE	**What are your 3 most important species ? (Local or species name)**	**Main gear used**	**What changes noticed in the overall harvest rate during the past 3 months?**	
	1.		☐ 5 (Improving a lot) ☐ 4 (Improving a little) ☐ 3 (The same / stable) ☐ 2 (Declining a little) ☐ 1 (Declining a lot)	
	2.		☐ 5 ☐ 4 ☐ 3	☐ 2 ☐ 1

Appendix 5: Data sheet and further information for Methods Sheet 10

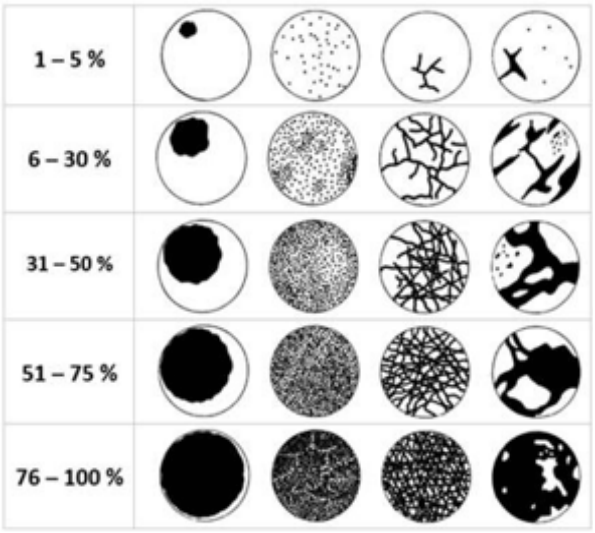
Communities monitoring habitats using observation.

1 - Live hard coral cover

Monitors estimate the percentage of reef area covered in live hard coral and mark it on the scale (soft corals are not recorded).



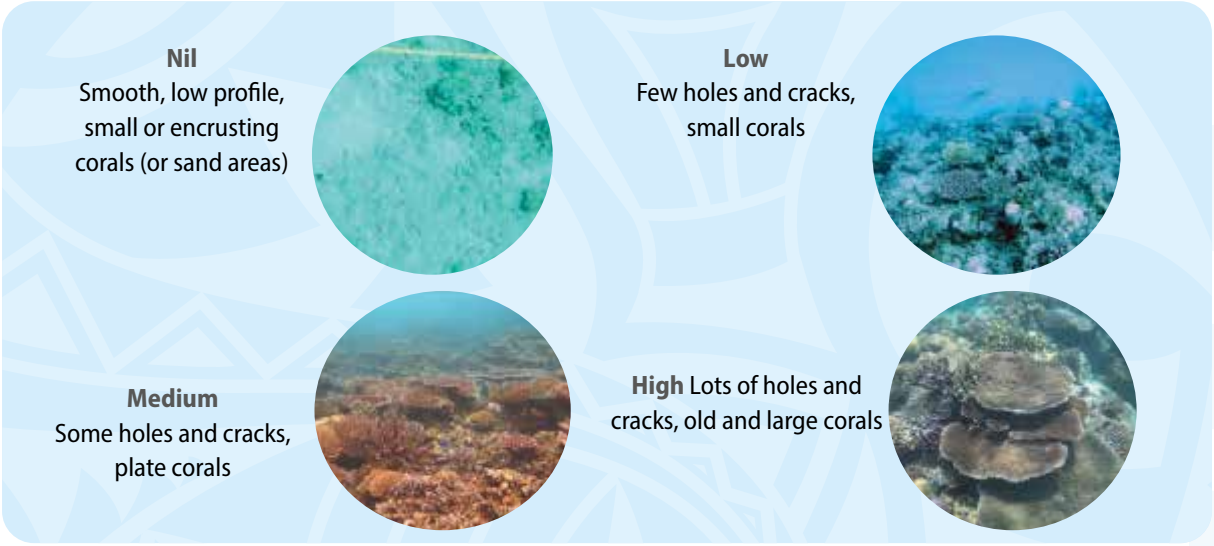
Coral cover scale used in the C2O Pacific Toolkits.



Dahl scale to assess live coral cover, as used in English et al. 1997.

2 - Habitat complexity (reef structure)

Monitors record the general habitat complexity over the whole site, using the scale from nil to high.



Scale used in the Vanuatu C2O community marine monitoring toolkit to assess habitat complexity.

3 - Reef diversity

Record how many different types of coral, fish and invertebrates there are on the reefs. As you snorkel through the survey site, ask yourself: "Does the reef have lots of different kinds of corals, fish and invertebrates?" Look for lots of different shapes, size, and colours in the coral. "Do you see many different types of shells (e.g. giant clam, coral clams, trochus)? How many different types of fish do you see? Are there many different shapes, colours, and sizes of fishes?"

In New Caledonia, reef diversity is focused on the diversity of habitats. The observer puts a 1 if the category is observed and 0 if not.

Code	Description	Code	Description
HCB	Hard coral branching	**SP**	**Sponge**
HCM	Hard coral massive	**OT**	**Other living organism**
HCT	Hard coral tabular	**RC**	**Rocks, limestone and dead coral with low algae cover**
HCO	Hard coral other growth forms	**RB**	**Rubble**
SC	Soft coral	**SD**	**Sand**
FS	Algae and seagrass	**SI**	**Silt**
FS*	Turf algae (thick)		

Reef diversity categories used in New Caledonia

3- Reef Impact Indicators

Monitors need to estimate the percentage of area covered or the number of individuals observed on a scale and report it on a slate or any other surface (e.g. a nail on a coconut palm frond). The definition of the scale is based on scientific information and previous monitoring reports. It is consistent across the four guides that currently exist. The indicators considered are algae, white coral and broken coral covers and the number of crown-of-thorns starfish.

If monitors can recognise and record what is likely to have caused the damage – e.g. storm/cyclone, boat anchoring – it will help decide on appropriate management actions.

CORAL REEF SURVEY SHEET

SITE DESCRIPTION (ONE FORM PER SITE)		
Who	Monitor names: Emma, Lyla, Phillipe	
Where	Village: Fulo	Site: Stony Pass
When	Date: 10 Jan 2023	Time: 10:20 am
Conditions	Weather: calm, clear, 28°C (sea temp)	Tide: ebbing
Habitat (circle one or more)	Reef lagoon	Reef front
	(Reef flat)	Reef slope

WHAT DID YOU SEE?	
1. Hard coral cover	Comments: 0% 10% X 30% 100% Low Moderate High

WHAT IMPACTS DID YOU SEE?	
1. Algae Cover	Comments: 0% X 10% 25% >50% Low Moderate High
2. White Coral	Comments: X 0% 10% 25% 100% Low Moderate High
3. Crown-of-thorn starfish (COTS)	Comments: 1 seen by 1 monitor only 0% X 1 5 50+ Low Moderate High
4. Broken coral:	Comments (note type of damage): 0% 10% X 25% 100% Low Moderate High

Litter present? (circle)	Lots	(Some)	None
Photos Taken? (circle)	(Yes)	No	
Photo Notes:	Photos of litter and broken coral		

Example of coral reef monitoring data collection sheet from the C2O community marine monitoring toolkit

Appendix 6: Data sheet and substrate categories for Methods Sheet 11

Programme officers monitoring habitats using point intercept transects

Code	Description	Definition
HC	Hard coral	All living coral, including bleached coral; includes fire, blue and organ pipe corals
HC/B	Bleached hard coral	
HC/D	Diseased hard coral	
SC	Soft coral	Include zoanthids but not anemones (OT)
RKC	Recently killed coral	Coral that has died within the past year; appears fresh and white or with corallite structures still recognisable
NIA	Nutrient indicator algae	All macro-algae except coralline, calcareous and turf (record the substrate beneath for these); Halimeda is recorded as OT; turf is shorter than 3 cm
SP	Sponge	All erect and encrusting sponges (but no tunicates)
RC	Rock	Any hard substrate; includes dead coral more than 1 yr old and may be covered by turf or encrusting coralline algae, barnacles, etc.
RB	Rubble	Reef rocks between 0.5 and 15 cm in diameter
SD	Sand	Sediment less than 0.5 cm in diameter; in water, falls quickly to the bottom when dropped
SI	Silt/clay	Sediment that remains in suspension if disturbed; recorded if colour of the underlying surface is obscured by silt
OT	Other	Any other sessile organism including sea anemones, tunicates, gorgonians or non-living substrate

Reef habitat categories used in Reef Check Indo Pacific

Code	Description
HCB	Hard coral branching
HCM	Hard coral massive
HCT	Hard coral tabular
HCO	Hard coral other growth forms
DC	Recently dead coral (white)
SC	Soft coral
FS	Algae and seagrass
FS*	Turf algae (thick)
SP	Sponge
OT	Other living organism
RC	Rocks, limestone and dead coral with low algae cover
RB	Rubble
SD	Sand
SI	Silt

Adapted reef habitat categories within the New Caledonia coral reef observation network.

Site name		Country/Island	
GPS		Village	
Transect depth		Start time	
Data recorded by		Date	

TRANSECT 1 0-19.5m				TRANSECT 2 25-44.5m				TRANSECT 3 50-69.5m				TRANSECT 4 75-94.5m			
0		10		25		35		50		60		75		85	
0.5		10.5		25.5		35.5		50.5		60.5		75.5		85.5	
1		11		26		36		51		61		76		86	
1.5		11.5		26.5		36.5		51.5		61.5		76.5		86.5	
2		12		27		37		52		62		77		87	
2.5		12.5		27.5		37.5		52.5		62.5		77.5		87.5	
3		13		28		38		53		63		78		88	
3.5		13.5		28.5		38.5		53.5		63.5		78.5		88.5	
4		14		29		39		54		64		79		89	
4.5		14.5		29.5		39.5		54.5		64.5		79.5		89.5	
5		15		30		40		55		65		80		90	
5.5		15.5		30.5		40.5		55.5		65.5		80.5		90.5	
6		16		31		41		56		66		81		91	
6.5		16.5		31.5		41.5		56.5		66.5		81.5		91.5	
7		17		32		42		57		67		82		92	
7.5		17.5		32.5		42.5		57.5		67.5		82.5		92.5	
8		18		33		43		58		68		83		93	
8.5		18.5		33.5		43.5		58.5		68.5		83.5		93.5	
9		19		34		44		59		69		84		94	
9.5		19.5		34.5		44.5		59.5		69.5		84.5		94.5	

			T.1		T.2		T.3		T.4						
# of HC with disease															
# of HC with bleaching															

If RKC is >10% is the primary cause: Bleaching. Storm. COTS Other

Comments:

Excel data substrate data sheet can be uploaded here.

Appendix 7: Suggested questions and data sheet for Methods Sheet 13

Communities monitoring socio-economic effects of CBFM using focus group discussion

Questionnaire to collect perceptions of fishing households on the socio-economic benefits of resource management (adapted from the Tonga CBFM scaling strategy)

Q#	QUESTIONS	RESPONSES	
1	Have the management rules affected income over the last quarter (or six months)?	5 Improving a lot 4 Improving a little 3 The same / stable 2 Declining a little 1 Declining a lot	
2	Have the management rules affected the amount of marine food for each household over the last quarter (or six months)?	☐ 1 ☐ 2 ☐ 3	☐ 4 ☐ 5

Appendix 8: Suggested questions and data sheet for Methods Sheet 14

Programme officers monitoring socio-economic effects of CBFM using interviews

Questionnaire to collect perceptions of fishing households on the socio-economic benefits of resource management (adapted from the Tonga CBFM scaling strategy)

Q#	QUESTIONS	RESPONSES
1	Have household incomes changed since the establishment of rules/since you last reported them?	☐ Increased ☐ Decreased ☐ No change
2	Has the fishing ground as a source of food for your community changed since the establishment of rules/since you last reported it?	☐ Increased ☐ Decreased ☐ No change
3	Has cohesion within the community changed since the establishment of the rules/since you last reported it?	☐ Increased ☐ Decreased ☐ No change

Appendix 9: Suggested questionnaire and data sheet for Methods Sheet 15

Programme officers monitoring socio-economic effects of CBFM using household surveys

Suggested subset of questions from the Tonga SMA survey (Tonga Ministry of Fisheries et al. 2021) and the SEM-Pasifika socio-economic monitoring guidelines (Wongbusarakum et al. 2008)

1. How has management affected the health of marine habitats in your fishing grounds?

☐ No effect ☐ Made worse ☐ Made better ☐ Don't know

2. Has the number of fish (and invertebrates) in your fishing grounds changed since the establishment of rules/ since you last reported on it?

☐ Increased ☐ Decreased ☐ No change ☐ Don't know

3. Has the size of fish (and invertebrates) in your fishing grounds changed since the establishment of rules/ since you last reported on it?

☐ Increased ☐ Decreased ☐ No change ☐ Don't know

4. Has the village observed a return of fish a https://www.socmon.org/#myCarousel nd/or invertebrates that had disappeared?

☐ Yes ☐ No ☐ Don't know

If yes, describe what fish or invertebrate

5. How well do marine resources meet community needs?

☐ More than enough ☐ Enough ☐ Barely enough ☐ Don't know

6. What is the activity that produces the highest income for your household over the last year?

☐ Fishing for reef fish ☐ Fishing for other (pelagic and bottom) fish
☐ Gleaning shells and invertebrates ☐ Aquaculture ☐ Coastal tourism-related activities
☐ Farming/growing crops ☐ Livestock ☐ Handicraft ☐ Salaried/wage employment
☐ Own/family business ☐ Remittances/money from relatives ☐ Other, please specify

7. Compared to before management, how has management changed the following?

Household incomes	☐ **Increased**	☐ **Decreased**	☐ **No change**	☐ **Don't know**
Using the fishing ground as a source of food for your community	☐ **Increased**	☐ **Decreased**	☐ **No change**	☐ **Don't know**
Number of household members who fish or harvest seafood	☐ **Increased**	☐ **Decreased**	☐ **No change**	☐ **Don't know**
Fishing/harvesting time	☐ **Increased**	☐ **Decreased**	☐ **No change**	☐ **Don't know**
Distance to fishing/harvesting site	☐ **Increased**	☐ **Decreased**	☐ **No change**	☐ **Don't know**

8. How has management affected the following?	No change	Worse	Better	Don't know
My household's participation in planning and decision-making related to marine resource management				
Access and availability of information that allow my household to better manage coastal and marine resources				
Effectiveness of enforcing community-based rules and regulations to protect fisheries resources				
Customary and traditional ways of managing fisheries being strengthened				
Inclusion of women and youth in fisheries management decision making and leadership				

9. **How has management affected conflicts?**

Within the village	☐ **No impact**	☐ **Decreased conflict**	☐ **Increased conflict**	☐ **Don't know**
With neighbouring villages	☐ **No impact**	☐ **Decreased conflict**	☐ **Increased conflict**	☐ **Don't know**

10. What does your household consider to be the top three threats to coastal and marine resources in your community?

☐ Harmful fishing practices ☐ Poaching ☐ Inadequate enforcement ☐ Lack of awareness of rules/regulations

☐ Breakdown of traditional fishing practices ☐ Invasive species/crown of thorns ☐ Pollution

☐ Climate change ☐ Mangrove deforestation ☐ Natural disasters



Pacific Community
Communauté du Pacifique

Produced by the Pacific Community (SPC)
B.P. D5 - 98848 Noumea Cedex, New Caledonia

spc@spc.int I www.spc.int

© Pacific Community (SPC), 2026

