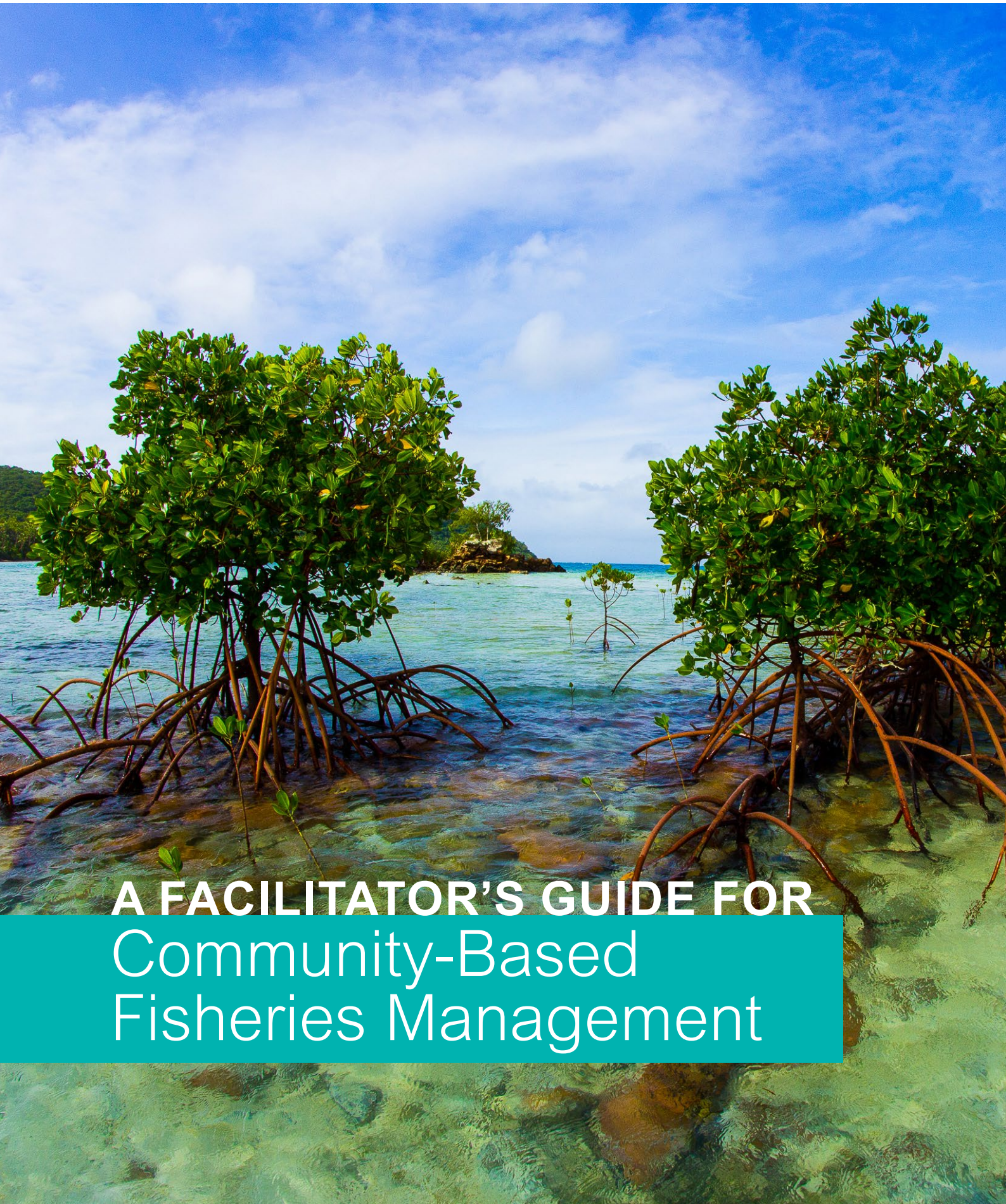
Wildlife Conservation Society



A FACILITATOR'S GUIDE FOR Community-Based Fisheries Management

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MODULE 1

Objectives and tools for community-based fisheries management

Overview

Participants will gain awareness of the range of different objectives for fisheries management and the different strategies that can be employed by communities within Locally-Managed Marine Areas (LMMAs). Basic concepts of adaptive management, and the need to resolve trade-offs between different fisheries objectives are introduced. A diagnostic tool prompts discussion about the local context for fisheries management, and facilitates identification of management opportunities and challenges. Following this exercise, additional learning modules will be recommended. Course materials for this module build upon an analysis of the effectiveness of different fisheries management strategies[1] in Melanesia.

MATERIALS REQUIRED

- *More fish, more food, more money* video (cChange)
- Module slides / flipchart
- Fisheries management diagnostic tool - enough printouts for all participants (see page 24)
- Maps of the customary fishing ground (*qoliqoli*) if available

Key messages

- There are a range of different fisheries management tools or strategies that can be used by communities within an LMMA.
- Communities can choose to mix and match different management tools, and adapt them to suit their needs.
- *Don't use a hammer to put in a screw!* Find the right tool for the job to address local management issues. Management tools need to be selected based on the local objectives and context for management.
- There are many different reasons, or *objectives*, for undertaking fisheries management, so "success" might look different to different people.
- *If you want to keep your outboard motor running, you need to service it!* Evaluate what is not working and make some fixes. Effective management also requires regular *evaluation* and fine-tuning the solution. Through community-based adaptive management, communities can learn whether management is working to achieve their objectives, and make changes if it is not.
- It might not be possible to achieve all objectives at once - *you can't have all your fish in the sea and eat them too!*
- Non-fisheries activities (e.g. deforestation, agriculture, foreshore development, mining) affect the health of marine habitats and fish stocks. If these other threats are not addressed, fisheries management on its own is unlikely to help stocks recover.

1 Cohen, P. J., Jupiter, S. D., Weeks, R., Tawake, A., Govan, H. (2014). Is community-based fisheries management realising multiple objectives? Examining evidence from the literature. *SPC Traditional Marine Resource Management and Knowledge Information Bulletin*, 34, 2–12.

1. Tools for fisheries management

OBJECTIVE

Participants know the different management strategies that are available to them, and that they can 'mix and match' different tools.

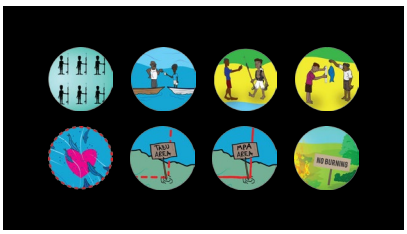
Show video: *More fish, more food, more money* (11 minutes, by cChange). Allow time for questions or discussion led by participants.

Facilitation tip: as you facilitate this module it is important to understand what communities are already doing, what national rules they know and are following, and then work with them to consider what more is needed?

Ask participants: firstly identify what traditional gears or management systems are currently being used to manage their *qoliqoli*. Secondly, ask participants to recall some of the different management strategies that were mentioned in the *More fish, more food, more money* video. These are:

- Limiting the number of fish people can catch in the *qoliqoli*
- Limiting the number of fishing licenses granted to outsiders
- Limiting destructive gear types (eg banning nets with small mesh sizes, spear fishing on SCUBA, use of *duva* root and dynamite)
- Imposing minimum size limits for fish and invertebrates
- Protecting spawning aggregation sites (eg for *kawakawa* and *donu*)
- Seasonal bans (eg for *kawakawa* and *donu*)
- *Tabu* areas
- Permanent no-take areas
- Rules for land use (eg limiting mangrove cleaning, banning burning, making sure garbage does not end up on the reef, banning fertiliser use)

Show slide: with all of the different management tools illustrated. Highlight any of the tools that the participants didn't remember.



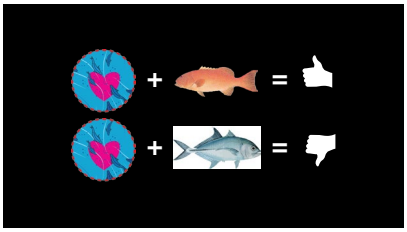
Show slide: don't use a screwdriver to put in a nail!

It is important to note that not all of these management options will be appropriate or effective everywhere. **Management strategies need to be chosen based on the species of concern, and the context within which they are being applied.**

Highlight that there are a number of factors to consider when choosing management tools, such as:

- whether it is feasible and affordable to implement
- whether the community will understand it
- whether the community, especially fishers (including men and women) are likely to comply with the management rules, and what the penalties would be for non-compliance
- whether it will help the community to achieve their goals (management objectives)

Show slide: example of matching management tool to species.



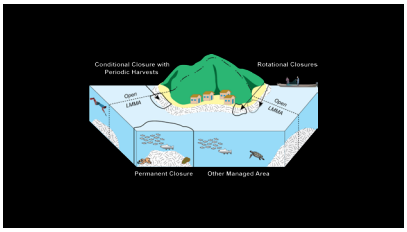
Give two EXAMPLES:

EXAMPLE 1: establishing seasonal bans can help to increase populations of *kawakawa* and *donu*, but this strategy will not be effective for other species that spawn all year round.

EXAMPLE 2: banning destructive gear types is a great idea, but if no-one is currently using those gears, a positive benefit may not be observed.

Explain that: different management options require different types of enforcement. For example, *tabu* areas or no-take areas might require someone to keep watch to ensure that no-one poaches; size limits require community compliance and fish wardens to ensure that outsiders stick to the rules. Each community will need to think about what is feasible for them. It is important that these discussions are gender and socially inclusive, to ensure everyone has the opportunity to contribute to the selection of management options.

Show slides: LMMA tools graphic and fisheries management "menu options".



This illustration shows how management options can be 'mixed and matched'. Communities do not just have to pick one tool, but will often use several in their *qoliqoli*.

Give three EXAMPLES:

EXAMPLE 1: Some communities have a *tabu* area, and also enforce size limits for fish and invertebrates, and limit the gear types that can be used throughout the *qoliqoli*.

EXAMPLE 2: Some communities do not have a *tabu* area, but use a variety of other management tools, like size limits, gear restrictions, requiring licenses for outsiders and managing activities on land to prevent sediment from running onto the reef.

EXAMPLE 3: Other communities have established permanent no-take areas to protect spawning grounds, and combine that with a size limit on fish caught throughout the *qoliqoli*.

Wrap up with: before choosing which management strategies to use, it is important to understand how they work, and who (e.g. men, women, youth, insiders, outsiders) will be affected by them. Other modules in this curriculum provide information that can help participants to design management strategies that will be feasible and effective in achieving local objectives.


Stacy Jupiter

2. Objectives for fisheries management

OBJECTIVE

Participants are aware that there are many different objectives for managing fisheries, and that the choice of which management strategy to use depends on what their objectives are.

Show slide: Mesake with his management objectives.

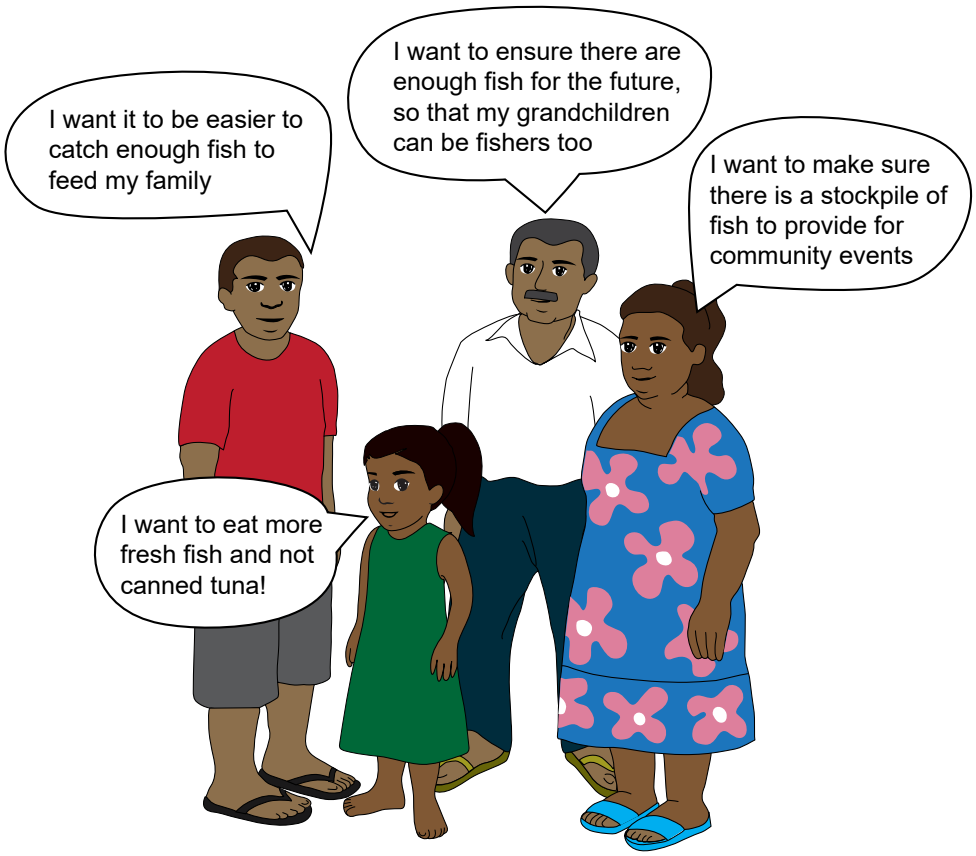
Discuss: In the video, Mesake wants to establish fisheries management in his *qoliqoli* so that he can easily catch enough fish to feed his family, meet his obligations, and earn some cold hard cash. The video also talked about ensuring the long-term sustainability of fisheries, so that there are plenty of fish for future generations to come. These are examples of different objectives than an individual or community might have for their fisheries resources, which provide a motivation for establishing an LMMA. It is important to consider if different groups in a community have different objectives. For example, women target different species and habitats, and may identify different objectives that need to be considered.

'Objectives' are statements about what we want to achieve by managing our fisheries. There are many different objectives for implementing fisheries management.

Show slides: indicating the diversity of different possible objectives for LMMAs.

Facilitation tip: Each slide has a person (including fishers, women, children, older people and youths) and their objective (e.g. "I want it to be easier to catch enough fish to feed my family"). As you show each slide, ask participants if they think that objective can be achieved through fisheries management, and in particular with the management tools discussed. Then follow up with an example or explanation of how the objective might be met, with caveats that management needs to be well-designed and complied with. Examples for each slide are provided in the table below, and in the PowerPoint notes.

Facilitation tip: Alternatively, instead of showing slides, ask participants to state their objectives for their LMMAs individually, or in small groups. If you are doing in groups, consider the composition of each group to make sure everyone will be comfortable giving inputs. Put all the ideas on a piece of butcher paper or a wall where everyone can see them, grouping similar ones together. Ask them if they think their objectives can be achieved through fisheries management, and in particular with the tools discussed. Then compare their objectives with the examples from other communities using the slides. Ask if any of these would apply to their LMMA, and follow up with examples of explanation of how the objective might be met, with caveats that management needs to be well-designed and complied with. Examples for each slide are provided in the table below and in the PowerPoint notes.



Objective Statement	Objective Category	Explanation of how objective can be met
I want it to be easier to catch enough fish to feed my family	1. Increase long-term sustainable fisheries yield for cash and food	*Tabu* areas (permanent and temporary), banning certain gear types, restricting the number of fishing licenses, size limits, seasonal closures and protection for spawning aggregation sites can all help to improve the status of fisheries resources, provided management is well designed and compliance is high. Some fish species are able to recover faster than others, and the time required to see results will depend on the status or health of the fishery before management is implemented.
I want to make sure there is a stockpile of fish to provide for community events	2. Increase efficiency of harvests and recovery of fish and invertebrate populations for short-term gain/ contingency needs	Many communities use LMMAs, and in particular *tabu* areas, to act as a “bank in the water” to ensure a supply of fish and invertebrates for special occasions or fundraising. When an area is closed to fishing, fish can become "tame", making them easier to catch when the reef is re-opened. However, whilst this strategy can produce benefits in the short-term, *tabu* areas need to be well-designed and managed for these benefits to be sustained across many harvest events. During harvesting events, consideration should be given to what fishing gear will be used and size limits.

Objective Statement	Objective Category	Explanation of how objective can be met
I want to eat more fresh fish and not canned tuna!	1. Increase long-term sustainable fisheries yield for cash and food	Permanent no-take areas, *tabu* areas, banning certain gear types, restricting the number of fishing licenses, size limits, seasonal closures and protection for spawning aggregation sites can all help to improve the status of fisheries resources, provided management is well designed and compliance is high. More fish in the *qoliqoli* means more fish to catch and eat, and less canned tuna for dinner! BUT, some fish species are able to recover faster than others, and the time required to see results will depend on the state or health of the fishery before management is implemented.
I want to increase my income from fishing, to provide for my family	1. Increase long-term sustainable fisheries yield for cash and food	Limiting the number of fishing licenses can reduce the commercial fishing pressure on the reef, making the resource more available for local communities with access rights to the *qoliqoli*. Setting specific yields per season or per year allowed. For some species (e.g. sea cucumbers, trochus, mud crabs) the selective harvesting of larger-sized animals will generate greater profit for the fishing effort. Understanding the market to determine when it is best to sell, or not sell, particular species (e.g. lower prices for mud crabs around Diwali), and look for opportunities to value add (e.g. sea cucumbers). And most importantly, not crashing the fishery, as the recovery process can be slow and lead to economic hardship.
I want to ensure there are enough fish for the future, so that my grandchildren can be fishers too	1. Increase long-term sustainable fisheries yield for cash and food	Establishing no-take areas can increase the number and size of fish within their boundaries; in time, there are so many fish inside the no-take area that some "spill over" into the rest of the *qoliqoli*. At the same time, fish that breed within the no-take area can export larvae to fished reefs, supplementing fisheries. In the long term, no-take areas are one of the best tools to improve fisheries sustainability, but they do need to be designed and managed well, and in the short term fishers will need to sacrifice some of their fishing ground. It is therefore important to ensure that all groups in a communities, including women, youth and other marginalised groups are part of this decision.
I want to organise a fish drive each year, to fundraise for school and provincial fees for the community	2. Increase efficiency of harvests and recovery of fish and invertebrate populations for short-term gain/ contingency needs	*Tabu* areas can increase the abundance of invertebrates and the catchability of fish (caught with spear guns), which can enhance catch efficiency and provide a good source of income in the short-term. However, harvests need to be carefully managed to insure against overfishing. Other management strategies can enhance fisheries in the long-term, benefitting both food security and income, where fish are caught for sale.

Objective Statement	Objective Category	Explanation of how objective can be met
I want to conserve the biodiversity on the reef	3. Maintain/restore biodiversity, habitats and ecosystem function	Some local management actions can help to conserve biodiversity on the reef. For example, restrictions on catching some species, and/or translocation of invertebrate species into *tabu* areas can encourage breeding. Management that helps to maintain healthy marine habitats can help a diversity of different species. In particular, communities can stop destructive fishing practices, protect areas of habitat that are important for sensitive life history stages, and ensure that land use practices do not reduce water quality downstream. Permanent no-take areas are considered some of the more effective ways of conserving biodiversity.
I want there to be as many fish in the *qoliqoli* as there was when I was young	4. Maintain/ restore biomass and breeding populations of targeted species	Establishing no-take areas, *tabu* areas, seasonal closures and protecting spawning aggregation sites can help depleted fish populations to recover. However, some fish populations will take longer to recover than others, and management needs to be designed with particular species in mind.
I want the community to earn money from tourists who visit the reef	5. Enhance economy and livelihoods	In some places, communities have received additional sources of income as a result of managing their LMMA. For example, communities in Kubulau receive voluntary user fee payments from divers in the Namena Marine Reserve, and the villages of Wainiyabia and Galoa on the Coral Coast receive payments in exchange for agreeing not to fish in the Shark Reef Marine Reserve. However, these opportunities are not possible everywhere, and are difficult to realise in remote or environmentally degraded areas. Permanent no-take areas might be required to preserve reef condition so tourists will continue to come.
I want to revive the traditional practices that we used to have in the village	6. Maintain or reinforce customs and tradition	LMMAs can often strengthen, re-establish or further evolve customary practices. For example, the communities of Totoya Island, originally declared the Daveta *tabu* a sacred passage following the sea burial of the stillborn child of a chief, and later reinforced this closure within their LMMA arrangements.
I think it's our responsibility to look after our resources	6. Maintain or reinforce customs and tradition 8. Increase community organization, cohesiveness and empowerment	Processes for establishing LMMAs frequently include bringing communities together for visioning, planning, decision-making and consensus building. These processes can help to increase community cohesion and organisation, whilst reaffirming and acting upon stewardship responsibilities that all Fijians share.

3. Trade-offs between objectives – *A fish can't be in your belly and in the ocean too*

OBJECTIVE

Understanding the trade-offs between different fisheries objectives.

To introduce this session, explain that:

Because there are many different goals, or objectives, for management, management "success" can have many different meanings. Success towards one objective (e.g., short-term increases in catch efficiency) may come at the expense of achieving others (e.g., enhancing long-term sustainability of resource-use or maintaining breeding biomass).

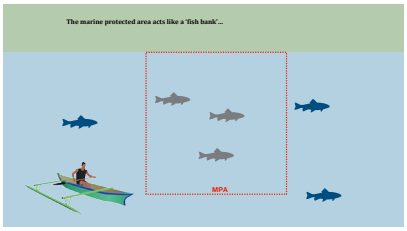
Show slides: with two people and their objectives, which might conflict.

EXAMPLE:

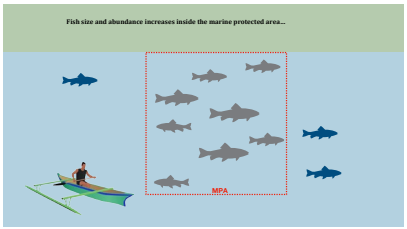
Josefa: "I want to make sure there is a stockpile of fish to provide for community events," vs.

Samisoni: "I want there to be as many fish in the *qoliqoli* as I remember when I was young."

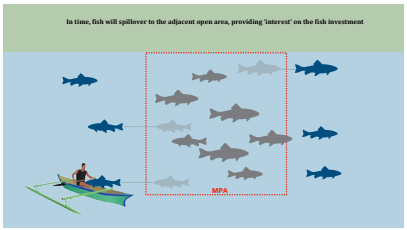
Show slides: explaining how Marine Protected Areas (MPAs), permanent no-take areas and *tabu* areas work.



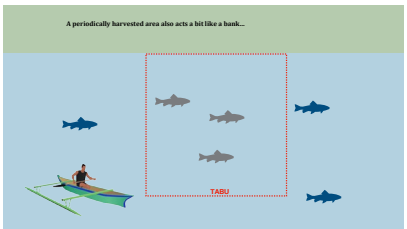
Explain how 'fish for the future' vs. 'short-term catch efficiency objectives' can conflict:



- MPAs or permanent no-take areas can act as a bank in the water
- When the area is closed, the number and size of fish inside the closure area increases
- If the area stays closed, spillover and larval export replenish other reefs nearby, providing "interest". If the *tabu* area is large enough and in place long enough, communities can "live off the interest", without needing to touch their savings. Now, Samisoni is happy (because the number of fish in the *qoliqoli* is increasing), but Josefa is not (because the area cannot be harvested for community events)



- *Tabu* areas can also act as a bank in the water
- Just like in a permanent *tabu*, when the area is closed, the number and size of fish inside the *tabu* area increases. As fish start to feel safe inside the closure area, they forget to be afraid of fishers and become less cautious



- When the area is opened for a harvest, there are lots of fish, and the fish are tame and easier to catch, particularly for spearfishers that can get much closer to their target before the fish swims away
- Then the area is closed again. If the *tabu* area is harvested regularly, there is no time for the interest to build up - fish populations outside stay the same, or maybe decline. Now, Josefa is happy (because there is a big harvest for community events), but Samisoni is not (because it is unlikely that the number of fish will increase to the level it was at when he was young)

If the *tabu* area is managed carefully so that harvests are infrequent and not all the fish are taken, it might be possible to provide a smaller harvest for some community events, AND see some increase in fish in the *qoliqoli*. Data from Fiji has shown that *tabus* should be closed for a minimum of 3 years before they are opened for harvest. However, if a fishery is well-managed with a number of other strategies (e.g. gear restrictions, size limits) communities may be able to harvest their *tabus* more frequently (e.g. 1-2 years).

Ask participants: if they think that both Samisoni and Josefa would be happy with that, or neither?

Alternatively, the community could decide to establish a permanent no-take area to replenish fisheries for the future AND a *tabu* area, to provide for community events.

Show slide: all the “community members”

Wrap up this module by emphasising that management success depends on how well a community works and makes decisions together. It is important that everyone (i.e. men, women, youth and any marginalised groups) understand and agree upon what the objectives for management are and what trade-off or compromises need to be made.

4. ACTIVITY: Fisheries management diagnostic tool

OBJECTIVES

1. Characterise the local context for undertaking fisheries management;
2. Identify which additional modules will be most relevant and useful to participants; and
3. Collect information that can be used to tailor subsequent information components.

This can be either a facilitated group discussion or breakout group activity, depending upon the number of participants and time available. If maps of the *qoliqoli* are available, these would provide a useful focal point for discussions.

Run the activity as follows:

1. If sufficient time is available, first ask all participants to answer questions (on a worksheet) individually. If participants want to select an option that is not listed, they can draw it in.
2. The diversity of answers can then be discussed in breakout groups. We suggest breaking out by demographic group (e.g. men, women, youth, and into subgroups of fishers vs. non-fishers).
3. Reconvene as a plenary group. Ask a representative from each group to provide a short summary of their discussions to identify areas of agreement or possible trade-offs among the community as a whole. It is important that facilitators create a comfortable space for everyone (including women, youth) in their communities to participate in discussions and the decision-making.

Based on the selections made, facilitators and communities can then choose which additional content and modules to look at.

The diagnostic questions with facilitator notes/prompts (in italics) are included on the next page.

A printable version of the worksheet is included on page 24.

Fisheries management diagnostic tool

What are our objectives?

Aims to identify whether the community has a single, shared objective for undertaking management or if trade-offs need to be resolved.

It is important that this be done with different groups in a community to see if there is a diversity of viewpoints on what the management objectives are. For example, it is important to understand if there are differences between men vs. women, fishers vs. non-fishers, the older vs. younger generation, as well as viewpoints of any marginalised groups.

It is important to identify ALL objectives here, so tick any that are proposed, even if not everyone agrees. It is also useful to identify the "top three" objectives, or the single most important, if consensus is reached easily.

What does the community want to achieve? Are they happy for things to stay the same, or do they want to see an improvement in the state of their resources? For what purpose?

- ☐ Increase long-term sustainable fisheries yield
- ☐ Increase efficiency of harvests for short-term yield
- ☐ Maintain biodiversity and ecosystem functions
- ☐ Maintain biomass and breeding populations
- ☐ Enhance economy and livelihoods
- ☐ Maintain or reinforce customs
- ☐ Assert access rights
- ☐ Increase community organisation, cohesiveness and empowerment

What is the current fishery status?

Aims to determine whether there is a perception of overfishing. It is expected that at least one box will be selected, indicating that there is concern about the status of fisheries resources.

Note that this is a rapid checklist − other exercises (e.g. recording oral histories, surveying spawning potential) describe or assess the status of fisheries in more depth. As a very rough guide, more boxes ticked indicates a broader perception of fisheries decline, but any boxes ticked indicates that there is a problem.

- ☐ Are fishers spending more time to catch the same amount of fish?
- ☐ Are the fish you eat getting smaller?
- ☐ Do fishers have to travel further to catch the same amount of fish?
- ☐ Are there species which used to be commonly seen in the *qoliqoli*, but are now rare?

Which species are we concerned about?

Aims to identify which management measures might be required, and to identify species to use as examples in later exercises. If partners have data on what species are in decline, it would be good in integrate this information into the discussions.

Participants may select any species (including invertebrates) but it is anticipated that focal species will include those for which SPC info sheets are available. Where other species are selected, facilitators should endeavour to create cut outs, identify movement ecology etc., for those to use in later exercises.

Ask participants to list local species of importance and concern. **Prompts**: Which are the most favoured food fish? Which species the community (or specific groups) do not want to lose from the *qoliqoli*? What are the species they have seen the biggest/fastest change in, in terms of size of fish, quantity of fish and/or catch rate of fish? Note that species-level information is necessary for some exercises, so if families are selected, ask for example species. Local names can be used, but where possible Gerald Allen's reef fish guide[2] should be used to determine Latin names (this can be done later with knowledgeable fishers from the group).

- ☐ Groupers
- ☐ Rabbitfish
- ☐ Emperors
- ☐ Parrotfish
- ☐ Reef snappers
- ☐ Trevallies
- ☐ Mullets
- ☐ Surgeonfish
- ☐ Sea cucumbers
- ☐ Mangrove crabs
- ☐ Saltwater mussels
- ☐ Sea urchins
- ☐ Marine algae
- ☐ Other (give details)

Who is fishing and who are they fishing for?

Aims to identify whether fisheries licensing and influence of middlemen, middlewomen and other traders is a concern, or whether fishing impacts are limited to the community.

We also need to know if there are too many people fishing or taking too many resources so that it impacts the ability to achieve local objectives. Tick all that apply.

Who is fishing?

- ☐ community members
- ☐ people from outside the community with relationships that enable them to fish here
- ☐ people from outside the community with no connection here

For those who sell, are they:

- ☐ licensed
- ☐ unlicensed (poaching)

2 Allen, G., Steene, R., Humann, P., Deloach, N. (2003). Reef Fish Identification: Tropical Pacific. NEW WORLD PUBLICATIONS, INC. Jacksonville, Florida USA.

Who / what are they fishing for?

- ☐ to eat, share or trade
- ☐ to sell within the community
- ☐ to sell outside the community

Note that there will most probably be a combination of people doing the fishing for different purposes. So, for each, they need to reflect on whether there is a problem with the amount that is being extracted by each group on their ability to achieve their own objective. If partners have relevant data (e.g. CPUE, gear types used), it would be good in integrate this information into the discussions.

They might think that there is a bunch of poaching, but if it does not affect anyone's ability to catch fish for local needs, then maybe they do not need to invest in management? However, if they still think there is a problem, maybe they have an unspoken objective to restrict access to only people with customary fishing rights and they need to actually voice this objective then to understand the appropriate management action (which would be to crack down on unlicensed fishers and deny issuance of approvals for licenses within their fishing grounds).

What gear are they using?

Aims to identify whether any unsustainable fishing is occurring, and to determine which types of management might be relevant. It is important for facilitators to remain neutral during these discussions if we want participants from the community to speak honestly and discuss the gear and fishing methods they use without fear of being ridiculed or reprimanded. By working with them to identify these destructive fishing gear or methods, we can then have genuine discussions in mitigating their negative impacts. It will also help facilitators gauge what if there is a genuine lack of awareness on fisheries laws.

We need to understand if use of certain gear types is negatively impacting vulnerable populations. Tick all that apply.

- ☐ spearfishing (day / night / scuba)
- ☐ hook and line
- ☐ mesh gill nets (small / large)
- ☐ gleaning
- ☐ traps
- ☐ dynamite
- ☐ *duva* root
- ☐ other (give details)

What management is ALREADY in place?

Aims to identify which follow up modules might be relevant and tailor course content accordingly (e.g. if existing *tabu* areas are in place, the *tabu* area design module can focus on assessing their adequacy).

This will also help participants to identify whether they have been using the right management tool to address key threats, and whether current management is sufficient. For example, if the only management they have is a small *tabu* area and people are night spearfishing and using fine gill nets in the open area, management will not be effective. It is also important to identify what traditional practices are being used.

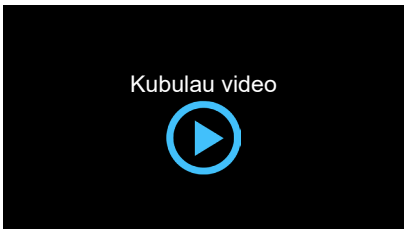
- ☐ Permanent closures
- ☐ *Tabu* areas (describe harvest schedule if known)
- ☐ Size limits
- ☐ Species bans
- ☐ Seasonal bans
- ☐ Gear restrictions
- ☐ Others (give details)

5. Adaptive management

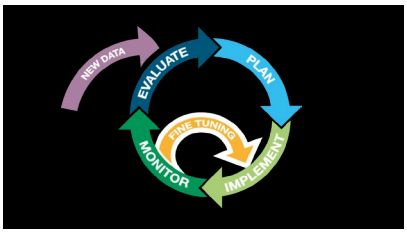
OBJECTIVE

Participants are aware that management put in place can be changed in future if it is not working.

Show video: Adaptive management in Kubulau.



Show slide: with adaptive management cycle figure



Explain that the basic process of adaptive management can be summarised as:

- Make a plan
- Implement the plan
- Check how it is going
- Revise the plan (if necessary)
- Carry on …

Relate this to what is discussed in the video.

Show slide: with gardening analogy. Explain that:

When you're planting cassava you don't just plant it and walk away. You go back and visit the gardens, check that it is growing well, maybe do some weeding and so on. If you find that your crops are not growing well, you wouldn't just keep planting the same things in the same places, would you? You might change to a different crop instead, or if the yield isn't enough to meet your family's needs, you might plant a larger area. This is just an example of adaptive management.

Adaptive management describes the ongoing process of designing and implementing management, seeing whether it is working, and making changes if it is not. Note that sometimes it can take a while, maybe even several years, to observe benefits from fisheries management. So, it is important to allow time for it to work before making changes. You wouldn't expect your cassava crop to be fully grown within a week!

Ask participants: what might trigger a community to make changes to their fisheries management.

Answer = if management is not achieving their *objectives*. Link back to there being many different possible objectives, and therefore different measures of success.

IF the community DOES have management in place (noting that it does not have to be a formal plan, and can also be a set of traditional management rules they have agreed to as a community):

Ask participants: to reflect on whether they think it is working; that is, if their objectives are being achieved? Then ask them how they know, or why that is their opinion. The aim here is to communicate the concept of 'monitoring' or measuring success, even where this occurs informally.

Possible answers = observations of how long it takes to catch enough fish, or the size of fish caught. Note that it is better to record these systematically, not just rely on perceptions and memory. Could they also conduct resource assessment surveys, for example snorkelling in *tabu* areas before harvesting?

If participants do not know whether their management is working, or are relying on "gut instincts", prompt them to consider how they might better measure success.

If participants disagree about whether their management is working, prompt them to consider whether this is because they have different objectives, and therefore different ideas about what success looks like.

IF the community does NOT have management in place:

Ask participants: hypothetically how they would know that management is not working?

The aim here is to communicate the concept of 'monitoring' or measuring success, even where this might occur informally. What measures would they use? Observations of how long it takes to catch enough fish, or the size of fish caught? Note that it is better to record these systematically, not just rely on perceptions and memory. Could they also conduct resource assessment surveys, for example snorkelling in *tabu* areas before harvesting?

Ask participants: what the options for revising management might be, if it is not working?
Options include:

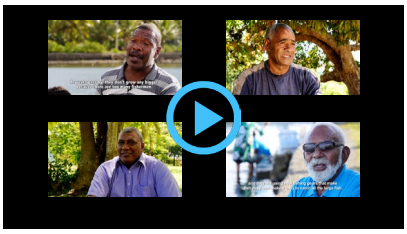
- Making sure that everyone agree with the rules and is complying with the rules
- Changing the design of existing management (eg the size, shape or location of *tabu* areas)
- Changing the management of *tabu* areas (eg keep it closed longer)
- Adding more management options within their LMMAs from the menu (eg gear or size restrictions, or limits on fishing licenses)

Emphasise that adaptive management requires keeping track of the results of management strategies put in place. Such monitoring needs to be designed to detect important indicators of success or failure that would indicate that the management strategy needs to be revised. This includes knowing which species to focus on, what to measure, and how long it should take for results to be noticeable. Communities do not need to rely upon outside assistance – there are monitoring methods that communities can do themselves, which are explained in a different module.

6. ACTIVITY: *Talanoa* - Recording oral histories

OBJECTIVE

Build a better understanding of trends in the status of fisheries resources, and an awareness of shifting baselines.



Introduce the activity by showing participants some of the Set Size Champions videos in which elders talk about how resources have changed: Ratu Rokotola, Sikeli, Tui Macuata, Porosa, Sanju

Ask participants: to talk to older fishers (both men and women) in the village about how resources and resource use have changed over their lifetime, and their perception of why things have changed.

This can be done by participants individually or in small groups, with responses recorded on paper or with flip cameras and presented back to the group the next day. If permission is given to record interviews with the flip cameras, interviews from different villages can be shared to discuss whether the same problems are occurring everywhere, or whether their local context differs. Try to get representatives from a diversity of groups (e.g. males vs. females, older vs. younger fishers).

Alternatively, the same questions can be asked (by a facilitator or community member) at an informal *talanoa* session around the *tanoa* in the evening.

***Talanoa* questions**

- What year were you born, and where did you live as a young person?
- What were the main kinds of fish and marine invertebrates you used to catch or harvest as a young person?
- What gear did you use to catch them?
- Where did you go to catch these species, how big were they, and how long did it take to catch enough to eat or sell?
- What changes have you observed in the size and abundance of marine fish and invertebrates during your lifetime?
- What do you think are the causes of the changes (if any) that you have observed?
- Did they have any traditional rules or systems in place to protect the fishery when they were young?

7. REVIEW

Summarise what has been learnt in this module.

- "Tools" for fisheries management and "Objectives" for fisheries management are different, and it is important to understand the difference
- There are a range of different fisheries management tools or strategies that can be used by communities within an LMMA
- Communities can choose to mix and match different management tools, and adapt them to suit their needs
- *Don't use a hammer to put in a screw.* Find the right tool for the job to address local management issues. Management tools need to be selected based on the local objectives and context for management
- There are many different reasons, or *objectives*, for undertaking fisheries management, so "success" might look different to different people. It is important that all social groups in a community (men vs women, fishers vs non-fishers, youth, and other marginalised groups) are included, and their viewpoints valued
- *If you want to keep your outboard motor running, you need to service it* – evaluate what is not working and make some fixes. Effective management also requires regular evaluation and fine-tuning the solution. Through community-based adaptive management, communities can learn whether management is working to achieve their objectives, and make changes if it is not
- It might not be possible to achieve all objectives at once - *you can't have your fish in the sea and eat them too!*

Sangeeta Mangubhai

FISHERIES DIAGNOSTIC WORKSHEET

What are our objectives?

- [ ] Increase long-term sustainable fisheries yield
- [ ] Increase efficiency of harvests for short-term yield
- [ ] Maintain biodiversity and ecosystem functions
- [ ] Maintain biomass and breeding populations
- [ ] Enhance economy and livelihoods
- [ ] Maintain or reinforce customs
- [ ] Assert access rights
- [ ] Increase community organisation, cohesiveness and empowerment

What is the current fishery status?

- [ ] Are fishers spending more time to catch the same amount of fish?
- [ ] Are the fish you eat getting smaller?
- [ ] Do fishers have to travel further to catch the same amount of fish?
- [ ] Are there species which used to be commonly seen in the *qoliqoli*, but are now rare?

Which species are we concerned about?

- [ ] Groupers
- [ ] Rabbitfish
- [ ] Emperors
- [ ] Parrotfish
- [ ] Reef snappers
- [ ] Trevallies
- [ ] Mullets
- [ ] Surgeonfish
- [ ] Sea cucumbers
- [ ] Mangrove crabs
- [ ] Saltwater mussels
- [ ] Sea urchins
- [ ] Marine algae

FISHERIES DIAGNOSTIC WORKSHEET

Who is fishing and who are they fishing for?

Who is fishing?

- ☐ community members
- ☐ people from outside the community with relationships that enable them to fish here
- ☐ people from outside the community with no connection here

For those who sell, are they:

- ☐ licensed
- ☐ unlicensed (poaching)

Who / what are they fishing for?

- ☐ to eat, share or trade
- ☐ to sell within the community
- ☐ to sell outside the community

What gear are they using?

- ☐ spearfishing (day / night / scuba)
- ☐ hook and line
- ☐ mesh gill nets (small / large)
- ☐ gleaning
- ☐ traps
- ☐ dynamite
- ☐ *duva* root
- ☐ other (give details)

What management is ALREADY in place?

- ☐ Permanent closures
- ☐ *Tabu* areas (describe harvest schedule if known)
- ☐ Size limits
- ☐ Species bans
- ☐ Seasonal bans
- ☐ Gear restrictions
- ☐ Others? (give details)

MODULE 2

Fish habitat, climate change, natural disasters & resilience

Overview

This module will focus on the interconnected nature of marine and coastal ecosystems, and therefore the importance of taking an "ecosystem approach to fisheries management" (EAFM). Participants will also learn about how local management actions might increase ecosystem resilience to, or promote recovery following, disturbances such as cyclones or coral bleaching.

Key messages

- Healthy fisheries require healthy habitats for fish and invertebrate species to live in
- Good fisheries management requires thinking about actions taken on land too[3]
- Badly damaged or degraded coral reefs might never recover. But if we keep reefs in good condition, we can entice more fish and coral larvae, to make the reef healthy and productive
- Even though some threats to coral reefs are out of our control (eg cyclones, climate change), local actions can help
- For example, we can manage populations of 'herbivore heroes' and 'coral reef killers' so that they can help reefs recover

MATERIALS REQUIRED

- *More fish, more food, more money* video - Fijian version
- Module slides
- Maps of the *qoliqoli**
- 'Spot the dangers' illustration print out

* NOTE that if maps of the area are not available, participants might be able to draw their fishing grounds on flipchart / butcher paper to complete this exercise.

3 For more details, WCS (2015) A facilitator's guide for ecosystem-based management planning in Fiji. Wildlife Conservation Society. Suva, Fiji. www.wcsfiji.org

1. What do fish and invertebrates need to restock your fishing ground?

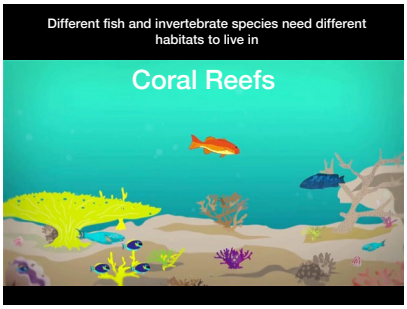
OBJECTIVE

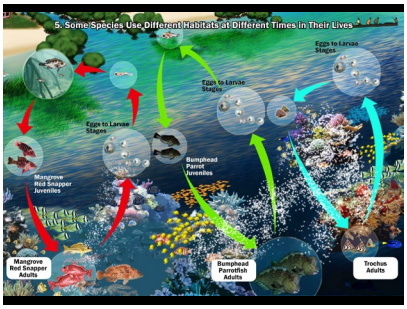
Participants understand the basic requirements for fish and invertebrate species that need to be considered in an ecosystem approach to fisheries management.

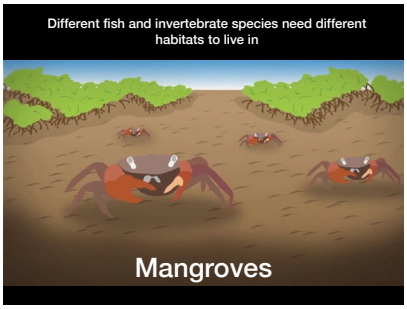
Facilitation tip: IF this module is NOT run straight after the introductory module, replay a section of the *More fish, more food, more money* video (3:20 – 5:26). The content in this module builds upon that introduction.

Show slides and recap that:

- Different fish and invertebrate species need different habitats to live in
- Some fish and invertebrate species need different habitats at different stages during their life cycle
- All these habitats need to be kept in good condition to encourage fish and invertebrates to live and reproduce so that their populations grow as fast as they can. Just like people, fish and invertebrates are fussy about where they live, and will choose to live in a nice habitat. Experiments have shown that fish larvae are attracted to reefs with lots of healthy corals – they smell good!







2. ACTIVITY: Mapping habitats in the *qoliqoli*

OBJECTIVE

Participants relate understanding of habitat requirements for fish and invertebrate species to their local environment.

- Divide the participants into breakout groups. It is important to create groups where people are comfortable speaking. For example, it may be important to group the men, women and youth separately
- If maps of the *qoliqoli* are available, each group should have one map. Each group will also need pens to draw on the map, ideally 4 different colours
- If maps of the *qoliqoli* are not available, provide each group with flipchart or butcher paper, and ask them to start by drawing a sketch of the *qoliqoli*, marking on key features like the shape of the coastline, and the location of villages and/or islands. If you don't have access to printed maps, consider using Google Earth to zoom over their area. You can project the map onto a large piece of butcher paper and the participants can trace relevant features needed to do this mapping exercise
- Ask participants to identify where each of the four main habitat types (coral reefs, seagrass, mangroves and sandy bottom) occur within the *qoliqoli*
- Make sure participants retain their maps for later use

Eferemo Kubunavanua

3. Why are we losing the places our fish need to thrive? Part I: local impacts

OBJECTIVE

Participants understand the key local impacts that degrade fish and invertebrate habitats.

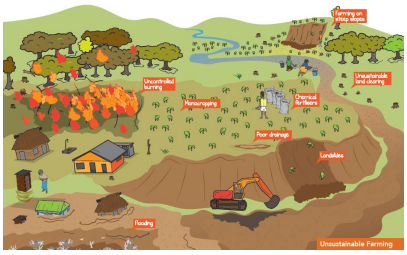
Show slides and recap:

Destructive fishing practices are like burning down a forest to catch a bird. Dynamite and *duva* root both kill fish that you don't want to eat; dynamite also destroys the coral that is home to fish and invertebrates.

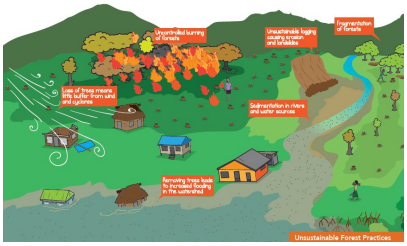
Watershed condition affects the health and well-being of people and the downstream environments in which they live. Recent studies indicate that there are cases of waterborne diseases like typhoid and leptospirosis within watersheds especially if you have high amounts of cleared land and livestock (e.g. cattle, pigs) accessing waterways. At the same time, changing the watershed areas (e.g. cutting forests) can cause flooding and pools of water can spread dengue.

Poor land use practices can cause sediment or pollution to run off onto the reef. These include excessive clearing of mangrove for firewood, building materials or space for houses; burning or clearing large areas; and allowing fertiliser, human or animal waste to flow into the ocean. This can have devastating impacts on freshwater and coastal coral reefs, which local people depend for food, livelihoods and cultural practice.

How we use the land is causing us problems



How we use our forests can affect us



4. Why are we losing the places our fish and invertebrates need to thrive? Part II: Natural disasters and climate change impacts

OBJECTIVE

Participants understand how natural disasters and climate change impacts can degrade fish and invertebrate habitats.

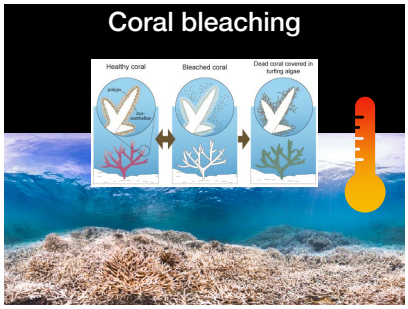
Introduce the session: Some impacts to coral reefs are large-scale and can seem out of our control. These include damage caused by natural disasters and climate change. Though we cannot stop a cyclone or lower the temperature of the ocean to stop corals from bleaching, there are actions that communities can take to make their reefs stronger and better able to withstand and fight back following these events.

Show slide: Cyclone damage to reefs

The damage caused by cyclones can be easily seen above the water, but there can be devastating impacts on coral reefs below the surface also.

Ask participants: Were they impacted by cyclones? What were the effects on land? Were impacts to coral reefs or other habitats observed?

Show slide: Coral bleaching



Explain how coral bleaching happens. The most important point to make here is that bleaching is caused by the ocean temperature becoming too warm.

Many people don't realise that coral is actually a living animal. In fact, a single coral is made up of thousands of small "polyps", and living within those polyps are thousands of microscopic zooxanthellae. The zooxanthellae are a type of algae, that live within and provide food for the coral, similar to how plants photosynthesize and get their energy from the sun. They are also what provides the coral with its colour. Without these little algae, corals can't survive.

When the ocean gets too warm, the zooxanthellae decide that their coral is no longer a good place to live, and they leave. This is what we see as coral bleaching – the corals all turn white because without the zooxanthellae, they have no colour. Unless the zooxanthellae return, the coral will die, which of course is bad news for the fish that feed on corals, and the fish that eat those fish, and the people that catch and eat *those* fish.

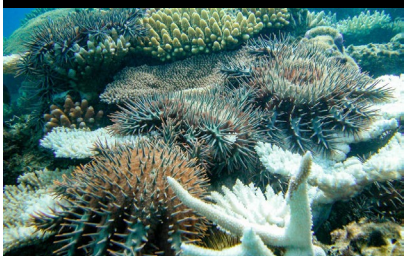
Ask participants: have they seen bleached corals on their reefs?

Show slide: crown-of-thorns starfish

Crown-of-thorns starfish occur naturally on the reef in small numbers. But they feed on coral, and so if they occur in large numbers, can cause large areas of the reef to die.

Ask participants: Have they seen crown-of-thorns starfish on the reef? Emphasise that it is natural for there to be a small number, and only when there is an "outbreak" with lots of starfish all over the reef is the reef in trouble.

Crown-of-thorns starfish



What can communities do?

Discuss with the communities some of the things communities can do. Focus the discussion around reducing threats to habitats and their natural resources. Examples of actions they can take include:

- Make sure upstream land use practices do not impact downstream habitats
- Protecting mangroves to protect against strong winds and waves
- Healthy coral reefs so that they can continue to provide fish and invertebrates after a cyclone event
- Establishing *tabu* areas that can be opened in the event of an emergency

5. ACTIVITY: Mapping threats to habitats in the *qoliqoli*

OBJECTIVE

Participants relate the threats that have been discussed to their *qoliqoli*, and understand which they might need to manage.

1. Ask participants to reform the groups in which they mapped habitats in the *qoliqoli*. It is important to create groups where people are comfortable speaking. For example, it may be important to group the men, women and youth separately.
2. Ask participants to discuss with their group whether the habitats drawn on their map are in good condition, or whether they have become degraded. Do they look the same as they did 10 or 20 or 30 years ago? If not, how have they changed?
3. Participants should indicate on the map where habitats are in good (☺) or poor (☹) condition, and if they have got better (+) or worse (-) over time.
4. Ask participants to answer two additional questions that will accompany their Fisheries Management Diagnostic from Module 1 (following page)
5. Ask one member from each group to present their map and summarise their group discussion.
6. Facilitate a discussion with the group about perceptions of habitat condition, and what the threats are to habitats. It may be useful to discuss inter-generational differences in perceptions.

7. **What is the current status of fish and invertebrate habitats in the *qoliqoli*?**

   Aims to determine whether habitats in the qoliqoli are in good condition or if they have already been degraded, how the quality of habitats has changes through time. Add multiple symbols to indicate extremes.

Habitat	Current Condition ☺ Good ☹ Poor	Change from 10 years ago + Better than 10 years ago o Same – Worse than 10 years ago
Coral reefs		
Seagrass		
Mangroves		
Sandy areas		

8. What potential threats to fish and invertebrate habitats are occurring?

Aims to determine the nature of the threats facing habitats – are they local or broader in scale, and are they originating from fishing practices or activities on land. Get participants to list the different habitats they have, and under each, list the threats to those habitats. Note that the severity of threats may depend on their extent – some cutting of mangroves is ok, but excessive clearing will cause problems. Identifying any potential threats allows them to be properly managed.

- ☐ Dynamite fishing
- ☐ *Duva* root fishing
- ☐ Clearing of mangroves, for firewood, building material or space for houses
- ☐ Burning or clearing large areas
- ☐ Human / animal waste flowing into ocean
- ☐ Fertiliser use on land
- ☐ Damage from past cyclones
- ☐ Previous coral bleaching
- ☐ Large numbers of crown-of-thorns starfish observed on the reef
- ☐ Others (give details)

6. The war between coral and algae

OBJECTIVE

Participants learn about the roles that herbivorous fishes play in maintaining healthy coral reefs.

Show slide: The war between coral and seaweed

Although it might look peaceful on the reef, there is a silent war going on, and not just between predators and their prey! Two of the reefs most passive looking inhabitants, seaweeds and corals, are locked in a battle for space. Seaweeds have deadly weapons that are invisible to us – they release chemicals which can harm or even kill corals who come into contact with it.

When corals are healthy, they win the battle. However, stresses and negative impacts weaken their defenses and can lead to reefs being taken over by algae. Reefs that have been taken over by algae smell bad to fish and coral larvae, so when they can, they choose to settle somewhere else, on a better quality reef. This means that badly degraded reefs may never recover.

Show slide: WANTED: for attack on corals

These are some of the culprits.

Ask participants: Have they seen these algae species on the reef?

Show slide: Herbivore heroes to the rescue!

Fortunately, corals do have some allies in the battle. These herbivore heroes feed on the seaweeds, giving the corals an advantage, where there are healthy herbivorous fish populations of course! These four species are responsible for 97% of grazing on harmful algae species in Fiji, so it's important that we maintain their populations.

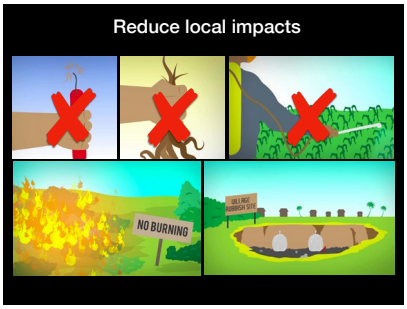
By protecting reefs, we can create a positive feedback loop - fish and coral larvae are attracted to nice neighbourhoods with good quality habitat, so well-managed reefs can get better and better!

7. What communities can do to improve the quality of fish and invertebrate habitats?

OBJECTIVE

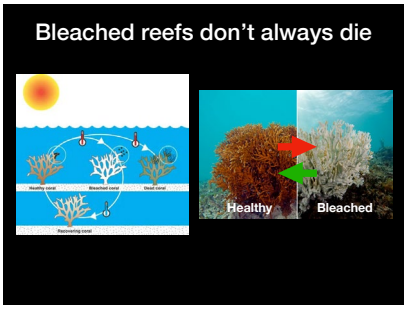
Participants learn about management actions they can take to improve the quality of fish and invertebrate habitats.

Show slide: Reduce local impacts



First, make sure that any local scale impacts responsible for degrading fish and invertebrate habitats are halted or effectively managed. Ban dynamite and *duva* root fishing, and prevent fertiliser use where it can run off into the ocean. Develop good land use practices including excessive logging (especially on steep slopes), restricting burning and ensuring that rubbish does not end up in the ocean. Include having a buffer of vegetation along waterways to reduce runoff of soils and pollutants into the rivers and marine environments.

Show slide: bleached reefs don't always die



Bleached corals, when they are brightly coloured or white, are very stressed but not yet dead. If the water temperature falls before the corals die, there is still a chance that they will recover. Whilst we cannot lower the temperature of the ocean, local actions to remove stresses caused by people can help reefs to recover.

We need to keep reefs in a healthy condition beforehand to give them the best chance at recovery.

Show slide: Even small, community-managed MPAs and *tabu* areas can help

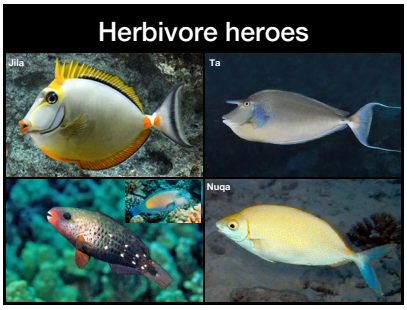
Small fisheries closures not only benefit populations of reef fishes, but they can also help coral reefs to be more resilient and recover following disturbances.

Well-managed fisheries closures contain more and larger herbivorous fishes than areas open to fishing. Herbivorous fishes feed on the algae that compete with corals, tipping the balance in the corals favour. As a result, MPAs and *tabu* areas may have more coral cover than fished areas.

Giving the corals a head start in the fight against algae is especially important if the reef is damaged, for example by bleaching or a cyclone, and needs to recover.

We need to protect herbivore heroes and crown-of-thorns killers. Just like in the village, everyone living on the reef has a different role to play in keeping the ecosystem functioning. Some species

have especially important roles in helping the coral to stay healthy, and sometimes, these are species that we also like to eat. So, it is extra especially important to make sure that we are not overfishing these species. Whether or not you have a fishery closure in your *qoliqoli*, it is important to make sure that these species are well looked after, so think about what other management strategies could be used to ensure that they are not overfished.



Show slide: herbivore heroes

On coral reefs in Fiji, these four species were found to do 97% of the work in keeping the reef free of harmful algae. Each one of them eats a different type of algae, so it's important that they are all there in healthy numbers.

Show slide: crown-of-thorns killers

If there is an outbreak of crown-of-thorns starfish on the reef, there are actions that communities can take to remove or kill them. But there are also fish and invertebrates that can help us out!

Some of these species, like the humphead wrasse (*varivoce*) and triton snail (*davui*) take a long time to grow, so we need to make sure that they are present on the reef to help out if there is an outbreak of crown-of-thorns, rather than waiting until there is a problem to look for a solution.

Building back better following a cyclone

Following Cyclone Winston, efforts are being made to "build back better" so that Fiji will be better able to withstand future storms and cyclones. Similarly, after a cyclone there can be an opportunity to rebuild fisheries in a more sustainable way.

Cyclones can have a devastating impact on fishing communities, with fishing gear and boats lost and destroyed. But fishing gear can be replaced with low-impact and more selective fishing gear.

Following a cyclone, reduce pressure on the reef by restricting commercial fishing licences to areas not impacted by the cyclone.

8. Review Key Messages

- Healthy fisheries require healthy habitats for fish and invertebrate species to live in
- Good fisheries management requires thinking about how actions on land affect the water
- Badly degraded reefs might never recover, but by keeping reefs in good condition, we can entice more fish and coral larvae, to make the reef get better and better
- Even though some threats to coral reefs are out of our control, local actions can help
- We can manage populations of 'herbivore heroes' and 'coral reef killers' so that they can help reefs recover


VCreative

MODULE 3

Size limits and spawning aggregations

Overview

One of the possible tools for managing fisheries sustainably are size limits. In this module, we will look at what size limits are and why they work, and we will discuss how they can be implemented. Distinction is made between legal size limits (and the role of fish wardens in monitoring these) and voluntary practices which fishers and communities can adopt. The second part of the module addresses the critical importance of protecting reef fish spawning aggregation sites and the time periods during which fish aggregate to reproduce (or 'spawn').

Key messages

- Declines in the size of fish and invertebrate species are an indicator of overfishing
- Fiji has legal size limits for some species, so make sure that you know what these are
- If using selective fishing gears, try to avoid catching undersize fish, leave the largest fish if possible, and leave berried (ie egg carrying) invertebrates
- Fish that aggregate to spawn are particularly vulnerable to overfishing; the best way to protect these species is to avoid catching them during the time they spawn

MATERIALS REQUIRED

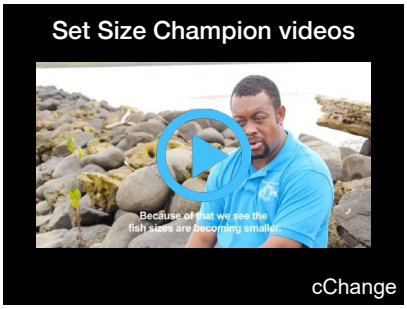
- Module slides
- "Set Size champions" videos (Sikeli & Isoa)
- Laminated fish with point scores
- Set Size fish stickers
- Fish rulers (if available)
- 4FJ campaign videos
- "*The search for the groovy grotto*" comic (if available)

1. Fish are getting smaller

OBJECTIVE

Participants learn about indicators of overfishing.

Show videos: "*Set Size" Champions Isoa Baleirotuma* and *Sikeli Naitura* (c. 3 minutes each).

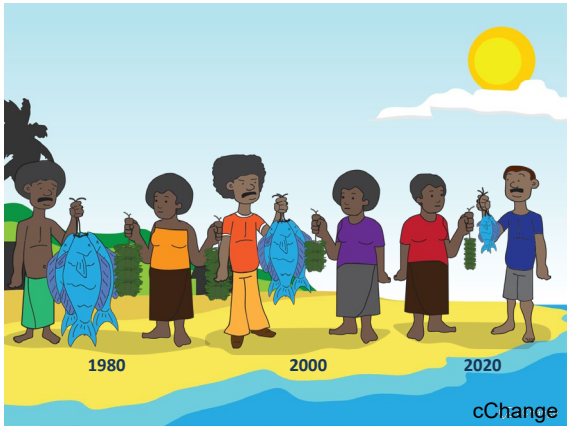


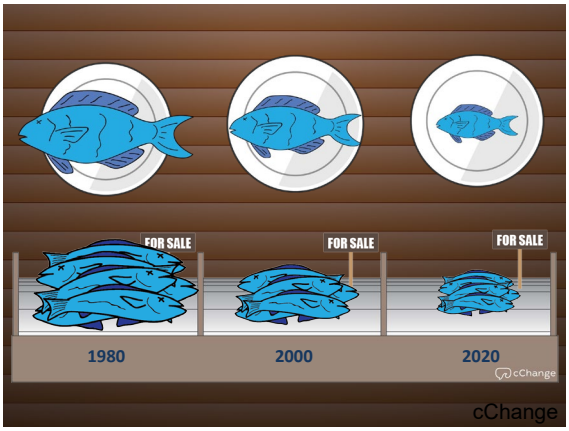
Ask participants: whether they have observed fish getting smaller in their *qoliqoli*, and why they think that is the case.

Show slides: from "Set Size" materials on fish getting smaller due to overfishing.

Read the explanatory text that accompanies each slide.

Emphasise that declines in the size of fish and invertebrate species seen and caught are an indicator of overfishing.





2. How size limits can help to manage fisheries sustainably Part I: minimum size limits

OBJECTIVE

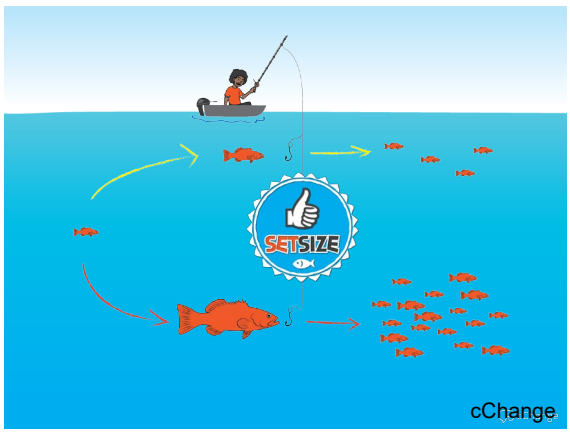
Participants understand how the “Set Size” can allow fish populations to increase.

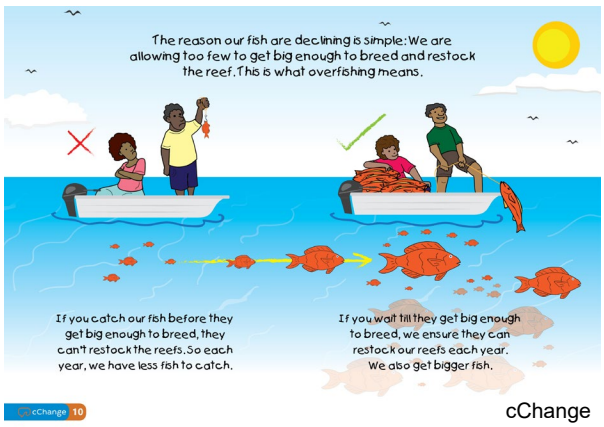
Introduce this section: Just like humans, fish have to reach a certain age before they can reproduce. If you stop catching fish smaller than that size, or the size were that fish becomes sexually reproductive, you can ensure that some fish are going to reach the stage where they will produce fish for next year. This is what we call size limits.

Show slides: “Set Size” animation of implications of catching fish before maturity, fishing down the food chain.

Read the **explanatory text that accompanies each slide.**

Emphasise that: Minimum size limits allow animals to mature and breed before they are caught. Different species reach maturity at different sizes. So to be effective, size limits should be applied to individual species.





3. ACTIVITY: How large?

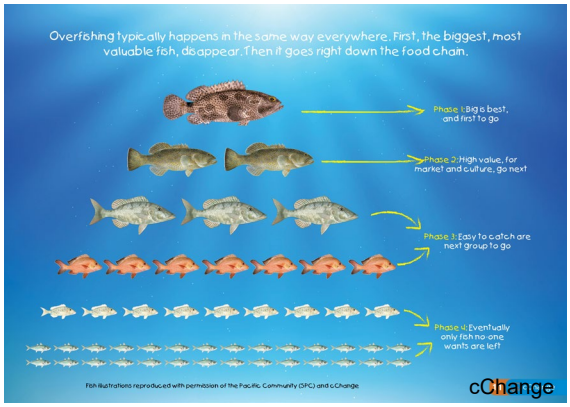
OBJECTIVE

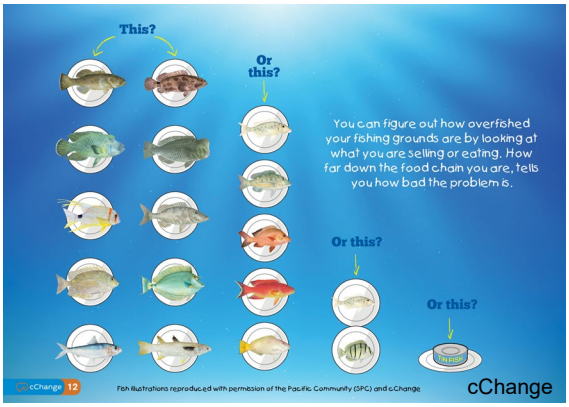
Participants get experience in understanding what the “set size’ looks like for some key species.

Show slides: with size at maturity for key species.

Ask participants to find household objects that fish wardens could use for rapid assessments of whether species are above or below the legal size limit (e.g. Solomons *trochus* size limit = tin of tuna).

Facilitation tip: If this module is taught on second day, participants can be asked to bring a common household item of a particular size (i.e. in cm) the next day. The group activity is then to match the item(s) to the species.



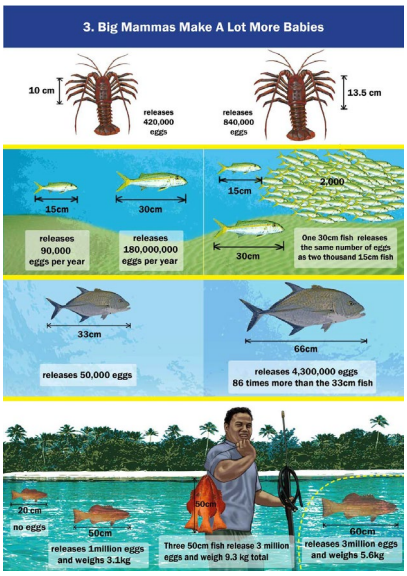


4. How size limits can help to manage fisheries sustainably Part II: maximum size limits

OBJECTIVE

Participants understand how maximum size limits, or choosing to leave some big old fish in the sea, can allow fish populations to increase.

Show slide: "Big Females Make More Eggs"



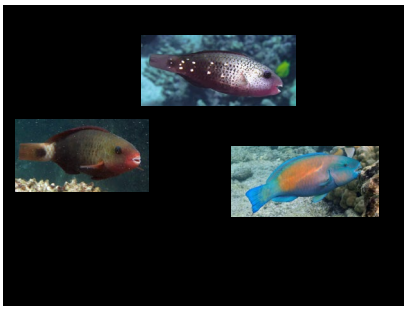
Emphasise that: Larger females lay many times more eggs than smaller fish.

EXAMPLES: lobster, goatfish, trevally, grouper

In many species, the offspring of big fish swim better, grow faster and live longer than ones from smaller mothers.

One of the best ways of preserving fish numbers is to protect some of these big fish. In addition to allowing target species to grow to be adults and reproduce, management should also consider protecting very large individuals who have the most reproductive power.

Show slides: with example of species that change sex endogenously (e.g. parrotfish that change colouration).



In addition, some fish change sex! Many families of reef fishes contain species which are "sequential hermaphrodites" – meaning, they all begin life as females, and then change to become males when they reach a certain size. If fishers remove all the largest individuals, only the females will be left. The population will have a "skewed sex ratio" (meaning of one sex than the other) and will be less able to replace itself through successful reproduction.

Emphasise that: Maximum size limits allow large animals with lots of eggs to breed, and might be important for sex changing species. If there are fisheries closures within the *qoliqoli*, large individuals will be protected there. If not, it might be wise to encourage fishers to avoid catching the largest individuals.

5. Implementation

OBJECTIVE

Understand Fiji's size limits and why they matter.

Size limits are some of the oldest tools for fisheries management. Participants should review legal size limits for fish and invertebrates in Fiji. Use species photos and size limits.

Minimum legal size limits for fish - SIXTH SCHEDULE (Regulation 18, under the Fiji Fisheries Act 1942)

Fijian name	English / scientific name	Minimum Length (mm)
Kaikai	*Pouter / Leignathidae: Gazza*	100
Matu	*Mojarra / Gerridae: Gerres*	100
Ika Droka	*Glassperch / Duclidae: Dules*	150
Ki, Ose	*Goatfish / Mullidae: Mulloidichthys Pseudopeneus, Upeneus*	150
Kabatia, Kake	*Small Sea Bream / Lethrinidae: Lethrinus*	150
Kanace	*Grey Mullet / Mugilidae: Mugil*	200
Nuqa	*Spinefoot Rabbitfish / Siganidae: Siganus*	200
Salala	*Long-jawed Mackerel / Scombridae: Rastrelliger*	200
Sabutu	*Small Sea Bream / Lethrinidae: Lethrinus*	200
Balagi	*Surgeonfish / Hepatidae: Hepatus*	200
Ulavi	*Parrotfish / Callyodontidae: Scarichthys*	250
Donu, Kawakawa, Kavu	*Rock Cod, Grouper / Serranidae serranus (Excluding small red Spotted cod)*	250
Kawago, Dokonivudi, Musubi	*Sea Bream / Lethrinidae: Lethrinus*	250
Saku Busa	*Garfish / Belonidae: Belone*	300
Yawa	*Milk Fish / Chanidae: Chaos*	300
Damu	*Snapper / Lutjanidae: Lutjanus*	300
Ta	*Unicornfish / Hepatidae: Naso*	300
Ogo	*Barracuda / Sphyanidae: Sphyrona*	300
Saqa	*Trevally / Carangidae: Caranx (Excluding vilu/Saqa)*	300

Ideal Minimum Size Limits for Fiji.

Species and numbers in bold are from data collected in Fiji.

Family	Scientific Name	Fijian Name	Size at Maturity (cm)	Current Fiji Size Limit (cm)	Proposed Minimum Size Limit (cm)
Barracuda	*Sphyraena jello*	*ogo buidromo*	50	30	55
	Sphyraena barracuda		**65**		**70**
Emperors	*Lethrinus atkinsoni*	*sabutu*	**25.3**	**20**	**25**
	Lethrinus harak	*kabatia*	**22.2**	**15**	**25**
	Lethrinus lentjan	*kabatia*	**20.6**	**15**	**25**
	Lethrinus obsoletus	*kabatia*	**24**	**20**	**25**
	Lethrinus ornatus		19		25
	Lethrinus rubrioperculatus	*kabatia*	22		25
	Gymnocranius grandoculis	*toma*	31		35
	Lethrinus erythracanthus	*sabutu damu*	**35.6**		**45**
	Lethrinus nebulosus	*kawago*	**41.2**	**20**	**55**
	Lethrinus xanthochilus	*kacika*	**39**		**45**
	Lethrinus olivaceus	*dokoni*	**49.8**	**20**	**55**
Goatfish	*Parupeneus barberinus*	*cucu/ose*	**32.5**		**25**
	Parupeneus cyclostomus	*cucu/ose*	**26**		**25**
	Parupeneus indicus	*ose, mataroko*	**25.7**	**15**	**25**

Family	Scientific Name	Fijian Name	Size at Maturity (cm)	Current Fiji Size Limit (cm)	Proposed Minimum Size Limit (cm)
Groupers	*Epinephelus fasciatus*	*kawakawa*	20	25	25
	Cephalopholis argus	*tikilo*	23	25	35
	Epinephelus spilotoceps		18	25	35
	Variola louti	*varavaranitoga*	**35**		**45**
	Epinephelus caeruleopunctatus	*kawakawa ni tiri*	**39.6**	**25**	**55**
	Epinephelus ongus	*sinusinu*	**32.6**	**25**	**35**
	Epinephelus cyanopodus	*kawakawa vula*	**40.5**	**25**	**55**
	Epinephelus maculatus	*kawakawa*	**39.7**	**25**	**55**
	Epinephelus polyphekadion	*kawakawa, kasala*	**41.2**	**25**	**55**
	Epinephelus tauvina	*kawakawa*	52	25	55
	Plectropomus areolatus	*batisai*	**43**	**25**	**55**
	Plectropomus laevis	*donu*	**49.8**	**25**	**55**
	Plectropomus leopardus	*donu damu*	**43.5**	**25**	**55**
	Epinephelus coioides	*soisoi*	**58.5**	**25**	**90**
	Epinephelus fuscoguttatus	*delabulewa*	**59.2**	**25**	**90**
Mackerel	*Rastrelliger kanagurta*	*salala*	26	20	25
	Scomberomorus commerson	*walu*	79		90
Milkfish	*Chanos chanos*	*yawa*	64	30	70
Mullet	*Crenimugil crenilabis*	*kanace*	**32.2**		**35**

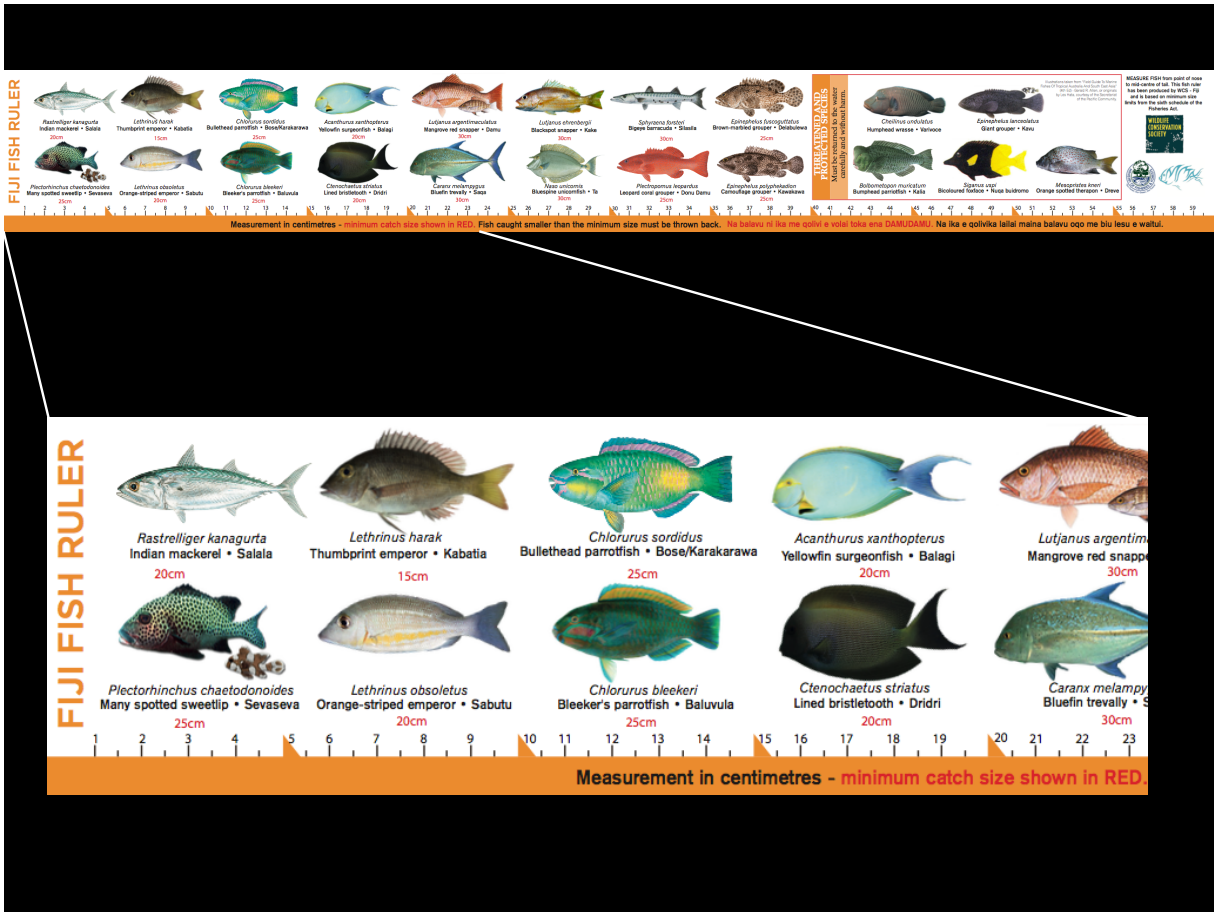
Family	Scientific Name	Fijian Name	Size at Maturity (cm)	Current Fiji Size Limit (cm)	Proposed Minimum Size Limit (cm)
Parrotfish	*Scarus ghobban*	*rawarawa ni nubu, ulavi*	**32.9**		**25**
	Scarus globiceps	*rawarawa, ulavi*	**27**		**25**
	Scarus niger	*rawarawa, kakarawa, karawa, bubute (small)*	**24.9**		**25**
	Scarus rivulatus	*rawarawa, bubute (small)*	**29.2**		**25**
	Chlorurus bleekeri		33		25
	Hipposcarus longiceps	*ulavi*	**36.5**		**45**
	Cetoscarus oscellatus	*laumarawa, dogo sasa*	36		45
	Hipposcarus rubroviolaceus	*rawarawa ni nubu, ulavi*	36.9		45
	Chlorurus microrhinos	*ulurua*	**37.5**		**45**
	Bolbometopon muricatum	*kalia*	68		90
Rabbitfish	*Siganus doliatus*	*nara vuso*	**20.4**	**20**	**25**
	Siganus puellus	*nuqa*	24	20	25
	Siganus punctatus	*nara loa*	**24.1**	**20**	**25**
	Siganus vermiculatus	*nuqa, volaca*	**23.6**	**20**	**25**
Snappers	*Lutjanus fulvus*	*kake*	20	30	25
	Lutjanus monostigma	*kake*	33	30	25
	Lutjanus quinquelineatus	*sara, sarua*	**18.4**	**30**	**25**
	Lutjanus semicinctus	*kake*	**22.3**	**30**	**25**
	Lutjanus agentimaculatus	*tiri damu*	**44.2**	**30**	**35**
	Lutjanus gibbus	*sabutu damu, damu, taea,*	**29.8**	**30**	**35**
	Monotaxis grandoculis	*mama, bu*	**34.6**		**45**
	Lutjanus bohar	*bati*	**46.8**	**30**	**55**
	Symphorus nematophorus	*tevulu*	40		45

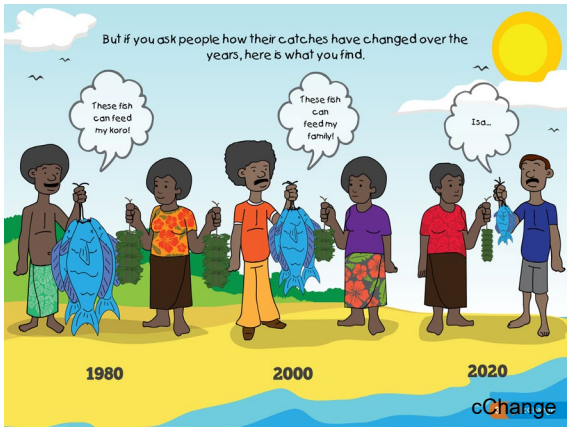
Family	Scientific Name	Fijian Name	Size at Maturity (cm)	Current Fiji Size Limit (cm)	Proposed Minimum Size Limit (cm)
Surgeon-fish	*Acanthurus blochii*	*balolo*	25	20	25
	Acanthurus lineatus	*balagi, dridrinitoga, balagi volavola*	18	20	25
	Acanthurus nigracauda	*balagi*	**19**	**20**	**35**
	Acanthurus nigrofuscus	*balagi*	**29.8**	**20**	**35**
	Acanthurus xanthopterus	*balagi*	**30.6**	**20**	**35**
	Naso annulatus	*tamasi*	54	30	45
	Naso brevirostris	*ta*	25	30	45
	Naso hexacanthus	*ta*	48	30	45
	Naso lituratus	*tamasimasi*	18	30	25
	Naso unicornis	*ta, ikayalewa, lele, tivitivi*	**37.1**	**30**	**45**
	Naso vlaminghi	*ta*	32	30	45
Sweetlips	*Plectorhinchus chaetodoinoides*	*sevaseva*	**43.7**		**55**
	Plectorhinchus albovittatus	*bici, drekeni-ni-toga*	**55**		**70**
	Plectorhinchus gibbosus	*tevulu*	**41.7**		**55**
Trevallies	*Caranx melampygus*	*saqaniva, tauta*	35	30	45
	Caranx papuensis	*saqa bui dromo*	**33**	**30**	**45**
	Caranx ignobilis	*saqa*	60	30	70
	Caranx sexfasciatus	*banito*	40	30	45
Wrasse	*Cheilinus undulatus*	*ulurua, varivoce, wagava*	55		90

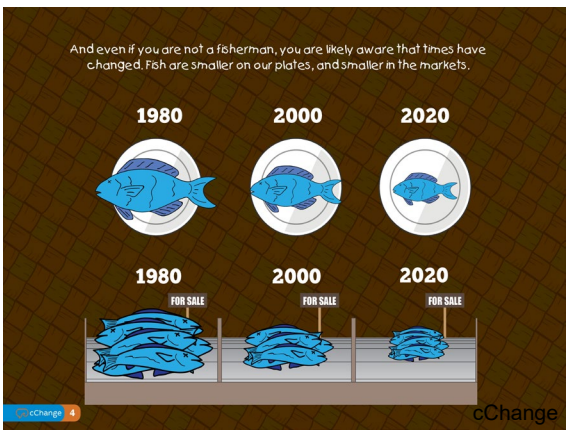
Emphasise that: fish wardens are able to assist the Ministry of Fisheries monitor legal size limits and can play an important role in building compliance with their communities. But even in their absence, best practice for fishing sustainably means avoiding catching undersize fish and invertebrates, leaving the largest individuals and leaving berried invertebrates. There are fines for fishers and/or fish buyers or sellers if they are in possession of undersized fish or invertebrates.

Show slide: Fiji fish ruler

Hand out fish rulers if available.







6. ACTIVITY: Fishing game

OBJECTIVE

To reinforce the role of fish wardens in monitoring legal size limits, and the poor sustainability of catching undersize fish and invertebrates.

- Place a pile of laminated fish (eg *kabatia, kawakawa, saqa, varivoce*) and invertebrates (eg mud crabs) of different sizes and species in the middle of the room
- Nominate 6 participants to play as fishers, and 2 to play as fish wardens
- Explain the rules of the game: 'fishers' will take turns to catch fish, they need to maximise the value of their catch without catching undersize or illegal fish
- Participants nominated as "fishers" take turns to catch fish
- Once all fish are caught, or fishers decide that they don't want to catch any more, "fish wardens" assess their catch and determine which are illegal, which are considered unsustainable, and which are ok. They do this by turning over the fish to reveal a point score based on size and value (ie larger and tastier fish score more points). Fish that are illegal catch (ie undersize) incur a penalty point. Fish that are protected (like *kalia*, the Napoleon wrasse or sharks) incur a penalty point. Fish that are legal, but not sustainable incur a lesser penalty
- **Facilitation tip:** you can test the rest of the participants by asking them to point out any fish they think are caught illegally before the answers are revealed by the fish warden. If fish rulers are available, "fish wardens" can demonstrate how to use these to check whether fish are under size
- The winner is the fisher with most points (you can award Set Size prizes if available!)

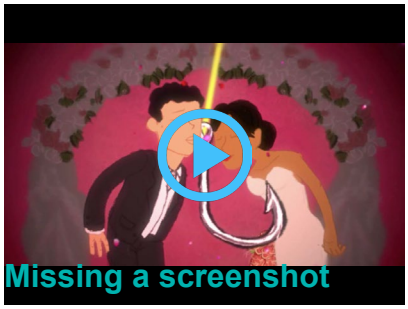
7. Spawning aggregations

OBJECTIVE

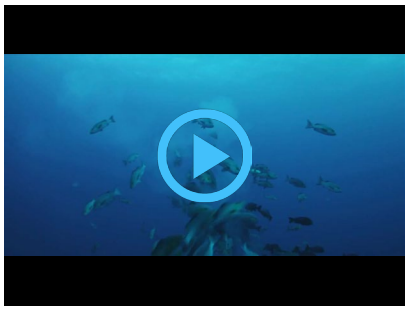
To understand why fishing spawning aggregations is not sustainable.

Introduce the session: So we have managed to protect fish until they are old enough and large enough to reproduce. What happens next?

Show video: *"Love interrupted"* (30 seconds)



Show video: Snapper spawning aggregation in Palau (4 minutes)



Show video: *Seeds of the Future: Fijian Spawning Aggregations* (18 minutes)

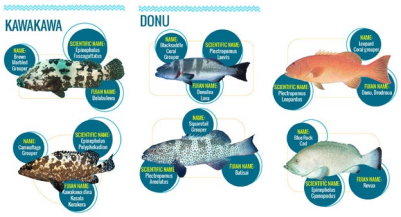
Emphasise that: the best way to protect these species is to avoid catching them during the time they spawn and at the places where they spawn.

Ask participants: Has anyone seen a spawning aggregation? Do they know where spawning aggregation sites are? Have they noticed the number of fish declining? Besides groupers, what other species aggregate together in large numbers to reproduce?

Show slide: 4FJ “Meet the Fish”

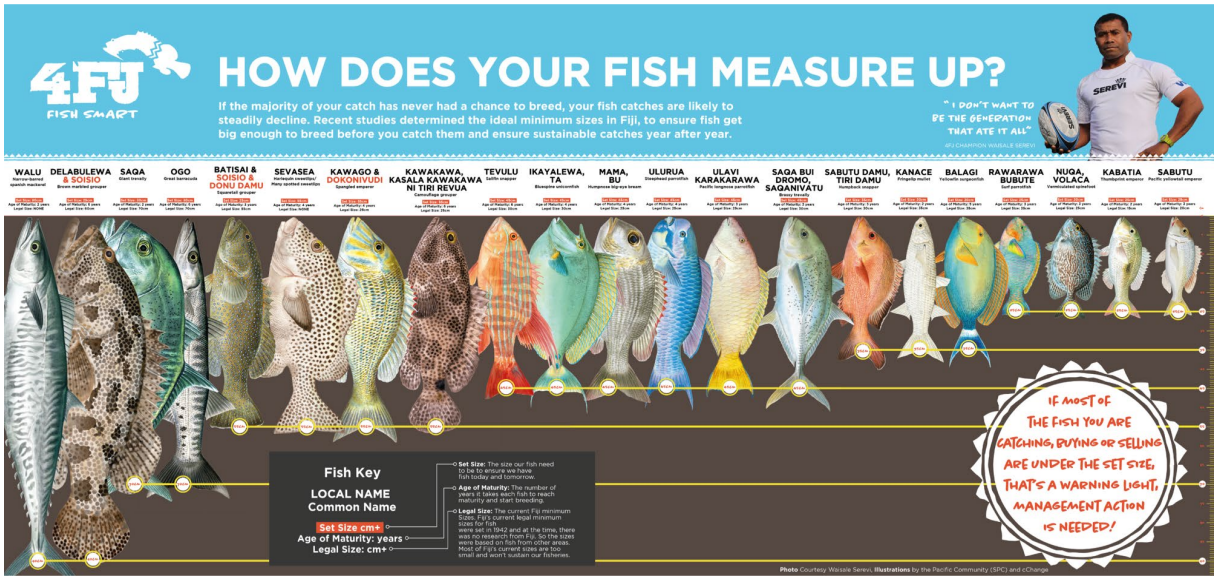
Ask participants: Do they catch these fish? Did they know that these fish have a spawning season?

Meet the fish



Show video: 4FJ Champions (30 seconds each)

Ask participants if they are willing to make the 4FJ pledge, or discuss doing so as a village.



8. ACTIVITY: The search for the groovy grotto

Distribute "*The search for the groovy grotto***" comic.**

Synopsis: Rock, the rock cod, and his friend have just come of age. They have just got their adult colouring so they are finally able to attend the annual reef fish ball. They have been hearing about this annual event all their lives and now is their chance to get in. Unfortunately times have changed and many values have closed down due to pollution and overfishing. The task seems hopeless, but they are not about to give up!

Take home message: As rock and the boys found out in the Search for the Groovy Grotto, with the increasing threats of overfishing, pollution and climate change to our coral reefs, it's getting harder and harder to find places for a fish to meet a nice girl and start a family. So why should that worry you?

We need fish to reproduce each year to ensure we have enough fish for food and for money in the years to come. What makes the issue even more serious for fish like the grouper, surgeonfish and rabbitfish in our story is that they gather in the same place every year to reproduce. By gathering in the sea place every year, these fish are very easy to find and overfish, Plus, if you fish them before they reproduce, then you get less and less new fish next year.

So if you care about ensuring there is enough fish for all our big annual feasts, we need to get busy. The best thing you can do is help spread the word about the need to protect these fish during the times of year they reproduce, what scientists call their spawning season. We can do that by (1) protecting spawning aggregation sites, which are the places grouper, rabbitfish and surgeonfish gather to reproduce, and (2) by stopping catching, buying and eating these fish during their spawning season. So join the movement to protect our future and make sure our plates never go empty.

Show 'reading notes' that parents can share when reading the book with their children to discuss at the end.

The search for the groovy grotto - Questions (and answers) that young readers might ask:

Q: Why can't younger fish go to the dance?
A: The dances are where the fish go to spawn / reproduce, so fish only go when they are mature. Some fish change colour as they grow from juveniles to adults, so that's why they talk about Rock getting his adult colours.

Q: Who are the creatures from above that are taking over the discos?
A: Humans! People fishing at the spawning aggregation sites can quickly deplete the fish numbers that visit them.

Q: Why are the old dance venues closed down?
A: People fishing at the spawning aggregation sites can quickly deplete the fish numbers that visit them. When the boys go to the first venue they are threatened by fishermen and have to flee. As Mr Shrimp says, "fish started disappearing. It was no longer safe and then fish stopped coming". They also see places with discarded fishing nets and oil drums – degraded habitats aren't a good place to hold a party! In real life too, there has been a decline in number of active spawning aggregation sites in Fiji.

Q: Why is the dance location a secret?
A: Because only adult fish can go, the location is a right of passage handed down to fish when they mature. They might also want to keep the location a secret to stop the fishers from above coming to spoil the party.

Q: Why do the friends split up when they finally get to the groovy grotto?
Q: What's the joke about Boulder ending up on the wrong level?
A: Sometime different species all use the same spawning aggregation site, but they typically aggregate at different levels in the water column. Otherwise they might accidentally spawn with a different species (like a sea cucumber!).

The search for the groovy grotto - Questions to ask young readers:

Ask what they learned from reading the book (about the fish, their behaviour, or what people can do to help sustain their populations).

Ask if they have any questions or want to know more about the story.

Ask what they thought would happen when they reached the groovy grotto. Did they realise that the annual reef fish ball is a pawning aggregation site? Have they heard of those before? Did they think the boys would be safe there or would that one too be threatened by fishers?

Ask if they recognise any of the characters, if they have seen them on the reef or on their plate.

Ask if they think there's a groovy grotto on the reefs near their village. Encourage them to speculate about where the grotto might be and where the boys might have passed through on their way. This helps to associate the characters in the story with real fish in the *qoliqoli*, and the responsibility to look after them.

If they want to help, talk about the 4FJ campaign. As a family, you can make the pledge to not catch, buy or sell *kawakawa* and *donu* for June through September.

9. REVIEW

Summarise what has been learnt in this module.

- Declines in the size of fish and invertebrate species are an indicator of overfishing
- Fiji has legal size limits for some species, make sure that you know what these are
- If using selective fishing gears, try to avoid catching undersize fish, leave the largest fish if possible, and leave berried invertebrates
- Fish that aggregate to spawn are particularly vulnerable to overfishing; the best way to protect these species is to avoid catching them during the time they spawn

Refer back to the fisheries management diagnostic tool, and which fishing gear types are used in the *qoliqoli*. Discuss which gear types are size-selective (i.e. fishers can avoid small or large individuals, or gear naturally preferences different sizes). Discuss what that means for the sustainability of fishing practices in the *qoliqoli*, and whether size limits are a management tool that the community could use. Look at the species identified as important, and whether any of those aggregate to spawn. Discuss whether the community can pledge not to sell or catch *kawakawa* and *donu* during their breeding season.

Margaret Fox

MODULE 4

Fisheries closure design

Overview

To be effective, fishery closures need to be both adequately designed and well-managed. In this module, participants will learn about how the design (i.e. size, spacing, location) of fishery closures relates to their potential effectiveness for different species. Information presented in this module will help participants to answer question such as: *Which species are protected within our tabu area? How large does our fishery closure need to be? Which is better – having one large tabu or a number of small tabus? Is protection of the reef flat only sufficient for fish and invertebrate populations to sustain themselves?*

MATERIALS REQUIRED

- Laminated / cut out fish for home range game
- Fijian blue highway infographic
- Fish SPC info sheets / fish playing cards

Key messages

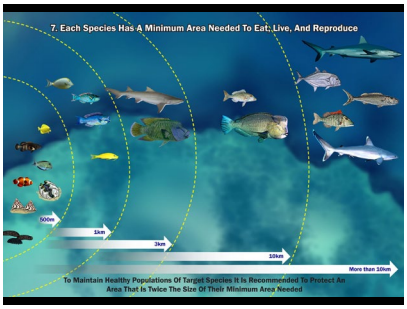
- The size of fishery closures needs to account for the home range size of the fish species that you want to manage
- Fishery closures need to be located on the habitat(s) that focal species use
- Fisheries closure boundaries should be clearly defined. This can be done by using natural features to mark the boundary (e.g. channels in reef)
- Fishery closures will not be effective for all species - those with very large home ranges need different management strategies
- Communities may need to work with one another to create a network of fishery closures

1. Home ranges: Some species need more space than others to eat, sleep, and reproduce

OBJECTIVE

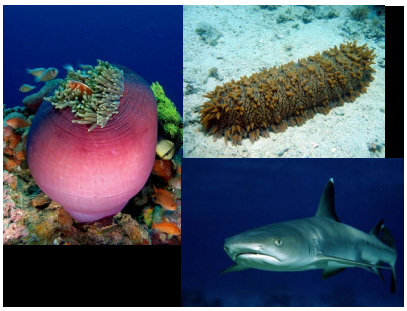
Understand the concept of a home range and how it can inform the design of permanent no-take or *tabu* areas.

Show slides: with home range concept and species examples



Explain that: An individual's "home range" describes the area where a fish spends most of their time, day to day. This includes where they sleep, where they forage for food, and where they socialise with others of the same species.

All animals have home ranges, including humans. If you think about your own home range, this would include your house and where you go to work or school every day. Occasional trips, for example to Suva / Savusavu / Nadi are not included in your home range. It's likely that some people in the village will have much larger home ranges than others. For example, fishers or farmers may travel further on a day to day basis than children who stay within the village.



Similarly, some fish species have much larger home ranges than others. For example, anemone fish can spend their whole entire lives living within one anemone. Sea cucumbers rarely move very far at all! Others, like some species of sharks and trevally can travel more than 10 km every day hunting for food. In between are other species, like rabbitfish and parrotfish, that make a daily commute from sheltered areas of the reef where they sleep to areas where they forage for food during the day.

Facilitation Tip: If participants ask how we know about fish homes ranges, you can explain that we know this because scientists have tracked individual fish or sharks over many days. They do this by catching the fish or shark and fitting them with a radio transmitting tag. The scientists can then follow their movements to see if they stay close to home, or travel far.

2. ACTIVITY: "*How far do fish move?*" game

OBJECTIVE

To highlight interspecific differences in home range sizes, as a foundation to using this information to design adequate fisheries closures.

Draw a distance scale on the wall / floor. Include the following distance brackets:

- Very small distances (less than 500 m);
- Small distances (less than 1 km);
- Medium distances (less than 3 km);
- Large distances (less than 10 km);
- Very large distances (10 km to 20 km)

Ask participants to guess the home range size of different species by placing cut-out fish (or post-it notes with local names if fish are not available) on the distance scale. This can be competitive, with different sets of fish for different groups of participants. Points can be awarded for whether the species are in the right distance bracket, in the correct order (i.e. smallest to largest home range sizes) and how accurate the distances are.

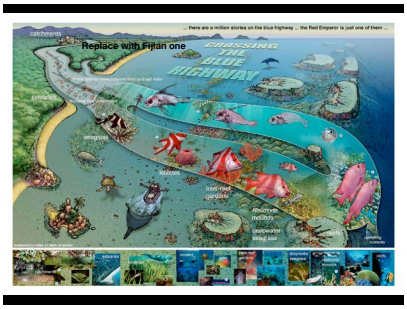
Alternatively, if cut-out fish are not available, show the fish on slides and ask people to call out the home range size.

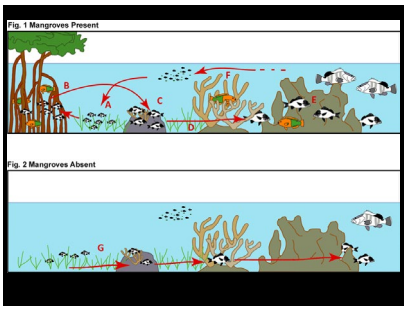
Facilitation tip: If possible, do some preparatory work before the session so that you can relate the distances to the present location. For example, how does the home range of different species compare to: the length of a rugby field (100 m)? the distance from here to the Church? to the next village?

3. Leaving home - Ontogenetic and spawning migrations

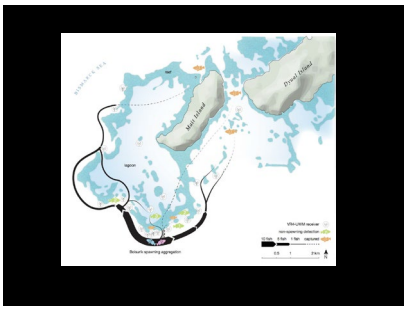
It is important to know that fish do occasionally move beyond their home ranges. Two common reasons for this are: (1) species that perform spawning migrations, where they undertake a much longer journey to aggregate with others and reproduce; and (2) species that move between habitat types as they grow older (this is called an ontogenetic migration).

Show slides: Fijian blue highway infographic with example of ontogenetic migration.





Show slide: Spawning migration map



Emphasise that: if fish move between habitats during their lifetime, all of those habitats need to be protected in some way. That doesn't mean that fishery closures are needed everywhere − often the main threats to nursery habitats are from poor water quality (e.g. caused by sediments or fertilisers from land).

Facilitation tip: If participants ask whether particular species move between habitats, you can say that we do not have good information on this for a lot of species. So, it is best to make sure that all habitats are well managed.

Revisit the cut-out fish, and whether each performs spawning or ontogenetic migrations (written on back).

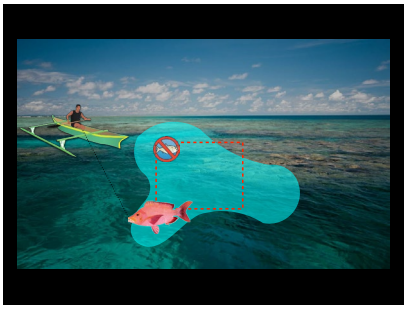
4. Designing adequate fishery closures

OBJECTIVE

Participants get practice in applying their understanding of how home range size relates to fisheries closure design.

Information about species' home range sizes, and whether and how often they move beyond their home range, helps us to design fishery closures that are able to protect them.

Show slides: home range size vs. *tabu* area size



Most importantly, if a fishes' home range is entirely within the fishery closure, it will be protected from fishing. If only part of its home range is within the fishery closure, it will only be protected for some of the time. Species that migrate outside of their home range will be vulnerable to fishing during that time.

ACTIVITY: Designing fishery closures (or checking adequacy) for key species

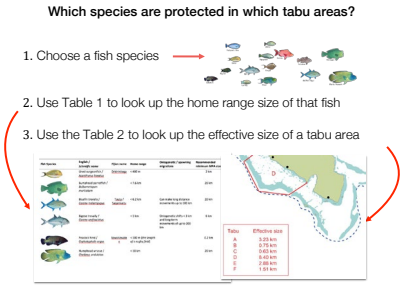
This exercise works best in small breakout groups. Ask participants to use information on (a) home range sizes of different species, and (b) hypothetical fishery closures, to work out which species are adequately protected. If information is available bring maps showing communities their *tabu* areas and what size they are.

For (a) Refer to the Module 1 diagnostic exercise to identify key species. Home range sizes and other info for key species are available in the table below.

For (b) Show map of closures in a hypothetical *qoliqoli* on projector or as handouts (page 63).

Facilitation tip: If fishery closures have already been implemented by the community, the approximate size of these can be compared to the hypothetical examples to give an idea of which species are adequately protected. If interested, participants can repeat the exercise with the actual dimensions of their *tabu* area and more species.

Show slides to walk participants through the exercise.



Ask participants to work out the following:

- Which species are adequately protected in which closures?
- Which species are not likely to be protected by fishery closures (ie those with large home ranges)?
- Which species need extra protection for longer migrations, and which habitats need to be protected?
- Optional - which species they would focus monitoring on (ie those that are adequately protected)?

Allow at least 30 minutes for groups to work out their answers. Many groups will need longer than this to think about all questions. It is important to recognise that men and women (or youth) may target different habitats and species, so it is important to be inclusive.

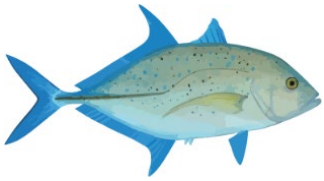
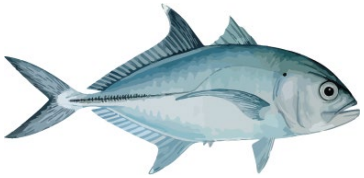
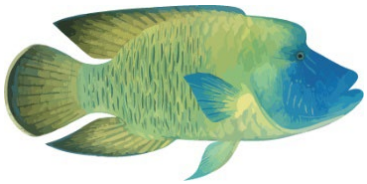
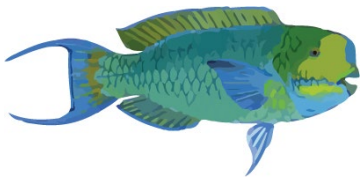
Ask someone from each group to report back in plenary what they found out. Encourage group discussion about how this might relate to their own community by thinking about:

- Which species were prioritised in the diagnostic exercise? How large are their home ranges? Are spatial closures appropriate management for them?
- How large are any existing closures? Which species are they likely to protect?

Summarise the answers:

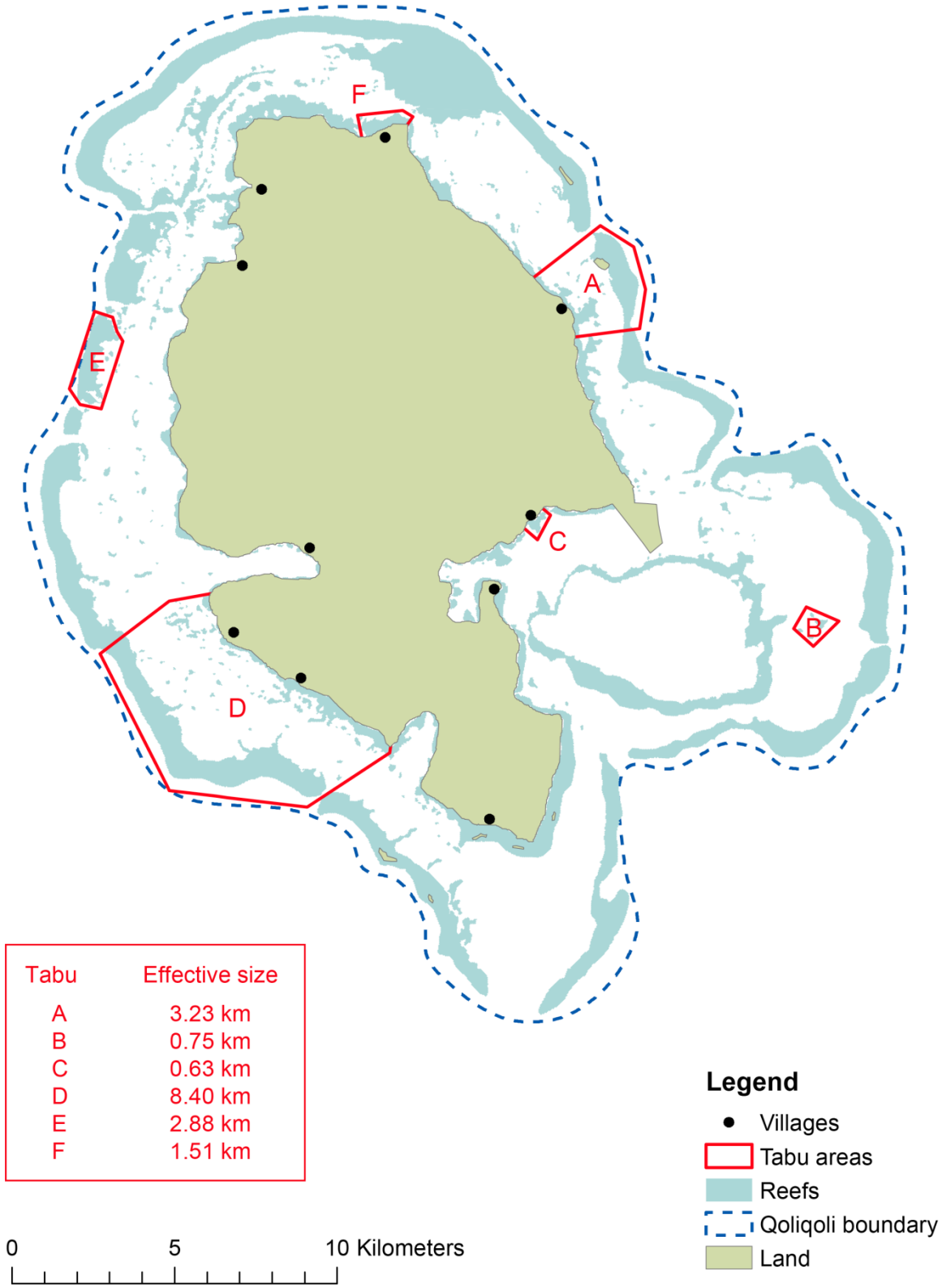
- Some species (*Naso lituratus, Caranx melampygus, Bolbometopon muricatum, Cheilinus undulatus, Epinephelus maculatus*) move too widely to be protected within any of the *tabu* areas. Different management strategies are required for these species
- *Tabu* areas B, C and F are only large enough to protect species with very small home ranges, like kawakawaloa. If F could be made just a bit larger, it could protect more species with small home ranges (like Dridrinitoga and some Nuqa)
- Tabu D provides protection for the most species, but not those with very large home ranges

Note that the full set of answers, i.e. which species are protected in which *tabu* area are included on page 67.

Fish Species	English / *Scientific name*	Fijian name	Home range	Ontogenetic / spawning migrations	Recommended minimum fishery closure size
	Lined surgeonfish / *Acanthurus lineatus*	*Dridrinitoga*	< 400 m		1 km
	Bumphead parrotfish / *Bolbometopon muricatum*		< 7.6 km		20 km
	Bluefin trevally / *Caranx melampygus*	*Tauta / Saqanivatu*	< 6.2 km	Can make long distance movements up to 100 km	15 km
	Bigeye trevally / *Caranx sexfasciatus*		< 1 km	Ontogenetic shifts < 3 km and long-term movements of up to 200 km	6 km
	Peacock hind / *Cephalopholis argus*	*kawakawaloa*	< 100 m (*the length of a rugby field*)		0.5 km
	Humphead wrasse / *Cheilinus undulatus*		< 10 km		20 km
	Steephead parrotfish / *Chlorurus microrhinos*	*Ulurua*	< 1.5 km	Inter-reef movements may be > 2 km	4 km
	Striated surgeonfish / *Ctenochaetus striatus*	*Dridri*	< 300 m		0.6 km

Fish Species	English / *Scientific name*	Fijian name	Home range	Ontogenetic / spawning migrations	Recommended minimum fishery closure size
	Highfin grouper / *Epinephelus maculatus*		< 4 km	Inter-reef movements up to 6 km	8 km
	Humpback red snapper / *Lutjanus gibbus*	*Bo, Yabo , Taea*	< 600 m (proxy based on *L. rivulatus*)	Possible long term movements up to 150 km	6 km
	Orangespine unicornfish / *Naso lituratus*	*Jila*	< 2 km		4 km
	Bluespine unicornfish / *Naso unicornis*	*Ta, Lele, Ikayalewa, Jivijivi*	< 500 m		1 km
	Streamlined spinefoot / *Siganus argenteus*	*Nuqa*	< 2 km		4 km

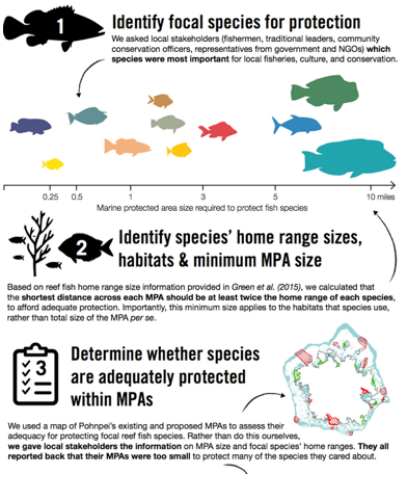
Hypothetical fishery closures handout



WRAP UP:

Show slide: infographic / animation on using home range information to design fishery closures. Emphasise that:

- The size of fishery closures needs to account for the home range size of the fish species that you want to manage
- Fishery closures will not be effective for all species - those with very large home ranges will need different management strategies
- Species that perform spawning or ontogenetic migrations require additional protection
- Fishery closures need to be located on the habitat(s) that focal species use. Protecting key sites, such as spawning aggregation sites, can provide additional benefits



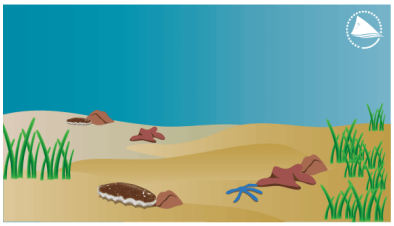
Show slides: designing adequate fishery closures for invertebrates

Explain that: Since we know that invertebrates, such as sea cucumbers, have very small home ranges, the size is not the most important consideration when designing a fishery closure for invertebrate species.

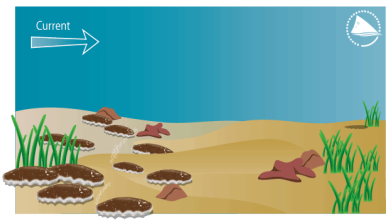
What matters most is the *density* of animals. Because they are not very mobile, male and female sea cucumbers need to be quite close together for their eggs and sperm to meet when they are released into the water column.

Communities can actually improve the chances of sea cucumber reproductive success by moving animals found elsewhere into their *tabu* area.

Reproduction: low density = poor recruitment



Reproduction: need high density for successful reproduction



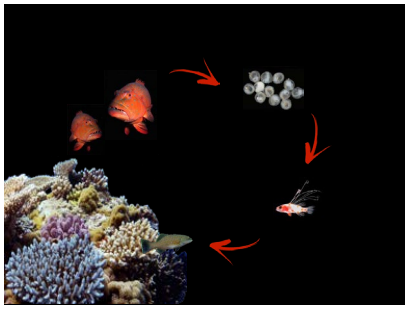
5. Working together – creating a network of fishery closures

OBJECTIVE

Understand how to design a resilient network of fishery closures.

Communities with small fishing grounds might find it difficult to establish large fishery closures. It might also be difficult for one community to protect all of the different habitats types used by key species. Communities therefore may need to work together to create several fishery closures along the coastline.

Show slide: Fish life cycle with larval dispersal

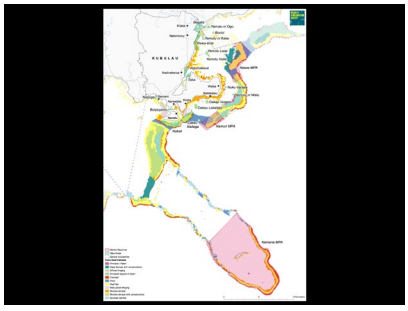


After fish spawn, their larvae drift in the ocean for days or weeks before settling back on the reef to begin their lives. If closures are small, many of the larvae will drift out of the closure to settle on other reefs nearby. This is good for fishermen, as it boosts the fish stocks that they can catch (it is the interest from the savings account inside the closure). But if all of the offspring from protected adults grow up far from home, how will the population inside the closure grow?

Show slides: Larval dispersal seascape overlay

Fortunately, although some larvae can travel a really long distance, many of them stay close to their parents, and most settle within 10−15 km from where they were born. We can use this information to know how far apart fishery closures should be spaced: if we space them less than 10-15 km apart, fish born in one closure have a chance to grow up in another. If multiple closures are placed in a network, they can exchange larvae, multiplying the benefits.

Show slide: Example of network of *tabu* areas in Kubulau District with arrows for potential dispersal between *tabu* areas.



Emphasise that: If communities work together to establish a network of closures, they should try to include a range of different habitat types used by different species, and to space them not more than 10−15 km apart.

6. REVIEW

- The size of fishery closures needs to account for the home range size of the fish species that you want to manage
- Fishery closures need to be located on the habitat(s) that focal species use
- Fishery closures will not be effective for all species - those with very large home ranges need different management strategies
- Communities may need to work with one another to create a network of fishery closures, that they can commit to and effectively implement

Finally, revisit the questions posed at start of module, and ask participants to answer them:

- How large does the *tabu* area need to be?
- Which is better – having one large *tabu* or a number of small *tabu*s within a fishing ground?
- Is protection of the reef flat only sufficient?
- Which species are protected within our *tabu* area?

NOTE: there is not a single correct answer to these questions. Responses should reflect learning about the factors that should inform decisions about the design of fishery closures.

Stacy Jupiter

7. Designing fishery closures ANSWERS

Fish	Tabu Area	Assessment of adequacy
Lined surgeonfish / *Acanthurus lineatus*	A	yes
	B	no
	C	no
	D	yes
	E	yes
	F	yes
Bumphead parrotfish / *Bolbometopon muricatum*	A	no
	B	no
	C	no
	D	no
	E	no
	F	no
Bluefin trevally / *Caranx melampygus*	A	no
	B	no
	C	no
	D	no
	E	no
	F	no
Bigeye trevally / *Caranx sexfasciatus*	A	no
	B	no
	C	no
	D	yes
	E	no
	F	no
Peacock hind / *Cephalopholis argus*	A	yes
	B	yes
	C	yes
	D	yes
	E	yes
	F	yes

Fish	Tabu Area	Assessment of adequacy
Humphead wrasse / *Cheilinus undulatus*	A	no
	B	no
	C	no
	D	no
	E	no
	F	no
Steephead parrotfish / *Chlorurus microrhinos*	A	no
	B	no
	C	no
	D	yes
	E	no
	F	no
Striated surgeonfish / *Ctenochaetus striatus*	A	yes
	B	yes
	C	yes
	D	yes
	E	yes
	F	yes
Highfin grouper / *Epinephelus maculatus*	A	no
	B	no
	C	no
	D	yes
	E	no
	F	no
Humpback red snapper / *Lutjanus gibbus*	A	no
	B	no
	C	no
	D	yes
	E	no
	F	no
Orangespine unicornfish / *Naso lituratus*	A	no
	B	no
	C	no
	D	yes
	E	no
	F	no

Fish	Tabu Area	Assessment of adequacy
Bluespine unicornfish / *Naso unicornis*	A	yes
	B	no
	C	no
	D	yes
	E	yes
	F	yes
Streamlined spinefoot / *Siganus argenteus*	A	no
	B	no
	C	no
	D	yes
	E	no
	F	no
Vermiculated spinefoot / *Siganus vermiculatus*	A	yes
	B	no
	C	no
	D	yes
	E	yes
	F	yes

MODULE 5

Tabu area management for sustainable harvests

Overview

To be effective, *tabus* need to be both adequately designed (see Module 4) and well-managed. Participants will gain awareness of how decisions about *tabu* area management (i.e. the frequency, duration and intensity of harvests) can influence their ability to achieve different objectives. Materials will be based on information about fish species life histories and intrinsic vulnerability, and integrate insights from research on *tabu* areas undertaken by the Wildlife Conservation Society (WCS) in Fiji.

MATERIALS REQUIRED

- Module slides
- Choose Your Own Adventure book / game

Key messages

- Decisions about when to open a *tabu* area and how much fish to take will influence management success and sustainability
- Best practices include forming a resource management committee, nominating fish wardens, enforcing the rules
- Short-term benefits are greatest when *tabu* areas are larger, closed for longer and well-enforced
- To maintain benefits over multiple successive harvests, communities must follow best practice for managing harvests, with controls on the amount of fish taken
- To achieve long-term fisheries management and conservation objectives it is best to combine *tabu* areas with complementary management strategies, eg permanent no-take areas, gear restrictions, seasonal closures

1. Objectives for periodically harvested *tabus*

OBJECTIVE

Understanding that there are different objectives for having a *tabu* area.

Show slide: Different people have different objectives.

Recap: There are many different reasons, or *objectives*, for undertaking fisheries management (see Module 1). This is also true specifically for periodically harvested fisheries closures, or *tabu* areas.

Remind people a *tabu* area cannot be affective on its own, but must been combined with other management tools such as gear restrictions, size limits, etc.

Show slide: Different reasons to harvest a *tabu* area.

Explain that: Traditionally, *tabu* areas were closed for 100 days following the passing of a chief or important community member. When the area was reopened, an intensive fishing effort would be carried out in order to catch a lot of fish for the funeral feast.

Today, hundreds of communities across Fiji have a *tabu* area, and there are more reasons why they are put in place.

Many *tabu* areas are still harvested for village social events, such as funerals or church functions. But in others, the catch from harvests is sold to provide a source of cash income for the village. For example, the Nakali *tabu* in Kubulau has been harvested to fundraise for the construction of a village church and village hall.

In other cases, communities hope that establishing a *tabu* area will help to boost fish populations throughout the *qoliqoli*, in addition to proving bumper harvests when required. The late Tui Wainunu Ratu Orisi Baleitavea has said that the three-year-old *tabu* in the *qoliqoli* of Wainunu has brought delight to his people. "They save money on fuel as they don't have to take their boats out far to sea to fish," he said.

In many cases *tabu* areas are favoured as a fisheries management strategy because they maintain or reinvigorate community traditions.

Increasing harvest efficiency for community events, providing cash income for fundraising goals, boosting fish populations and re-establishing traditions are all common objectives for *tabu* areas.

Whether a *tabu* area can achieve any or all of these objectives depends upon its design (See Module 4), and how it is managed. At the same time, to make good decisions about *tabu* area design and management you need to be clear about what your objectives are!

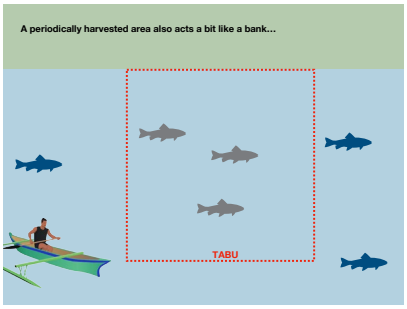
2. How *tabu* areas can work as fisheries management tools

OBJECTIVE

Participants understand that they need to leave enough time between *tabu* area harvests for fish populations to recover.

Show slides: Permanent no-take areas versus *tabu* areas.

Just like in a permanent no-take area, when a *tabu* area is closed to fishing, the number and size of fish inside the area increases through time.



Show slide: Fish get caught off guard

As fish start to feel safe inside the closed area, they forget to be afraid of fishers and become less cautious. When the area is opened for a harvest, there are lots of fish, and the fish are tame and easy to catch, particularly for spearfishes that can get much closer to their target before the fish swims away.

Fish get caught off guard when the tabu is opened = risk of over harvesting

Fishing communities benefit because they can catch a lot of fish, and large fish, within a short period of time. Thus, *tabu* areas are a particularly effective fisheries management strategy for increasing short-term fisheries yields from single harvest events.

BUT the increased catchability means that a LOT of fish can be removed with very little fishing effort. This means there is a real risk of harvesting too much in one go.

This is a problem because it compromises both future harvests and long-term management objectives.

Show slide: A cautionary tale from Kia Island

A cautionary tale from Kia Island

In September 2008, Kia Island communities collectively decided to harvest the *Cakaulevu tabu* to raise funds to support school, church and provincial fees for island residents. Their goal was to raise FJ$12,000 from the sale of invertebrates and fish.

WCS surveyed reefs inside and outside the *Cakaulevu tabu* before the harvest, and found lots more fish inside the *tabu* area than in the adjacent fished area.

The community exceeded their FJ$12,000 goal on the first day! People were fishing round the clock 6 days a week, and family members returned from Suva to join in.

The harvest period was extended for 5 weeks, creating an estimated total revenue of FJ$200,000. By then there were few fish left in the *tabu* area.

One year after the harvest event, WCS returned and found that total fish biomass had not recovered inside the *Cakaulevu tabu*, and the biomass of large fish like trevally and groupers was nearly exhausted everywhere.

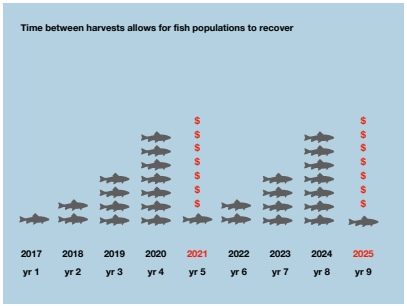
It was likely that the *tabu* area was being poached. Community members blamed outsiders, but were likely fishing the *tabu* area themselves.

It is unlikely that Kia residents intended to collapse the fish stocks completely, but without controls in place to manage the harvest, it got out of hand.

Emphasise the take home messages:

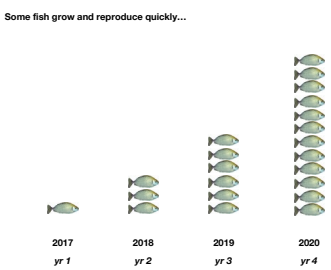
- the Kia Islanders took so many fish from the *tabu* area that fish populations were unable to recover, and they no longer see any benefits from it
- If outsiders perceive no enforcement, they may be more likely to poach
- Once business relationships were established with middlemen, ease of market access may have eroded compliance with management rules

Show slides: Time between harvests allows for fish populations to recover



Emphasise that communities need to allow enough time for fish populations to recover inside the *tabu* area before they harvest it again. Some fish, like rabbitfish/*nuqa*, grow and reproduce quickly; others like humphead wrasse/*kalia* won't benefit from this strategy as they are slow growing, have large home ranges and are extremely vulnerable to overfishing.

Show slides: with fish population growth and harvest through time.



More frequent harvests must remove fewer fish to allow faster recovery, otherwise, fish populations and harvests will gradually collapse. Smaller AND less frequent harvests might allow some fish to spillover to open areas.

Show slide: Waisea and Tevita

Remind participants about possible trade-offs between objectives. Note that this applies to *tabu* areas too, using the following example:

Waisea wants to make as much money as possible all year but Tevita wants to be able to "cash out" occasionally to support school fees at the beginning of the school year.

Keeping the *tabu* area closed for much longer means that the *tabu* will also help to sustain fisheries throughout the *qoliqoli* – good for Waisea but maybe not for Tevita.

There may be some people in the village whose livelihoods depend almost exclusively on fishing, but others might want benefits at certain times of the year, and these benefits could be compromised if fishing pressure is too great during the year.


Stacy Jupiter

3. Best practice for managing *tabu* areas

OBJECTIVE

Participants learn best practices for managing *tabu* areas to achieve short-term and long-term benefits.

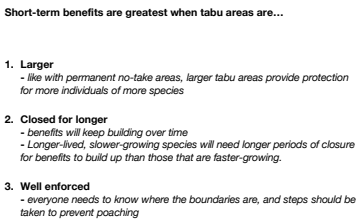
Show slide: *Tabu* area management (people with questions)

Managing *tabu* areas is a lot more complicated than permanent no-take areas, because in addition to making decisions about the size and location of the *tabu*, communities need to decide how long to leave the *tabu* closed, when to harvest, how much fish biomass to remove, and which species to take.

All of these extra variables can influence the effectiveness of this form of management. Some communities have been using *tabu* areas successfully for many years, but others have had disastrous results, as we have just seen.

WCS and fisheries scientists set out to try and understand how *tabu* areas can be used to manage fisheries safely and effectively. Here's what we found out.

Show slides: Recommendations



Short-term benefits are greatest when *tabu* areas are…

1. Larger
   - like with permanent no-take areas, larger *tabu* areas provide protection for more individuals of more species. Generally *tabu*s that are <1 km^2 are likely to be too small to be effective
2. Closed for longer
   - benefits will keep building over time
   - Longer-lived, slower-growing species will need longer periods of closure for benefits to build up than those that are faster-growing
3. Well enforced
   - everyone needs to know where the boundaries are, and steps should be taken to prevent poaching

Note: there may be some species (especially those that are highly vulnerable with wide movement patterns) that will not benefit from a *tabu*, and other tools (e.g. size limits, protection of spawning aggregations) may be more effective.

To maintain benefits over multiple successive harvests, communities must conduct harvests sustainably…

1. Strict controls are needed to prevent overfishing once *tabu* areas are opened
    - Leave some fish behind to kick-start recovery for the next harvest
    - Focus harvest effort on fast growing and abundant species; avoid taking large predators (grouper, sweetlips, jacks, jobfish, sharks) and large parrotfish
2. Strict deadlines are needed to stop fishing
    - Harvests should not generally last longer than 1–2 days
3. Sufficient recovery time must be allowed for between harvests
    - At least 3 years of closure between harvests is recommended to restore fish abundance and biomass to pre-harvest levels
    - Longer-lived, slower-growing species will need longer periods of closure for benefits to accrue than those that are faster-growing

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   - *At least 3 years of closure between harvests is recommended to restore fish abundance and biomass to pre-harvest levels.*
   - *Longer-lived, slower-growing species will need longer periods of closure for benefits to accrue than those that are faster-growing.*

To achieve long-term fisheries management and conservation objectives you need to:

1. **Combine *tabu* areas with complementary management strategies, e.g. permanent no-take areas, gear restrictions, seasonal closures.**
    - Removal of large individuals during harvests may reduce the reproductive output of *tabu* areas and limit benefits of larval or adult spillover that are seen in **permanent no-take areas.** Therefore, to achieve long-term management objectives, a complementary suite of fisheries management and conservation strategies (eg, no-take areas, gear restrictions, catch limits) in conjunction with *tabus* will likely be required

Emphasise that the best way to ensure that *tabu* areas are managed to achieve their objectives and ensure sustainable fisheries is to:

- form a resource management committee, who will be responsible for making decisions about why, when, and how long for, the *tabu* can be opened
- nominate fish wardens, to make sure that everyone complies with the rules

4. ACTIVITY: Choose your own adventure

OBJECTIVE

Best practices for managing *tabu* areas are reinforced by participants reading a 'Choose Your Own Adventure' story.

Facilitator notes: The story has choice options related to the design and management of a *tabu* area. Depending on the choices made, different outcomes arise. If the reader reaches an unfavourable ending, they can start again from the beginning, or trace back their steps and change one of their choices. This story aims to teach readers about the implications of decisions relating to *tabu* area management.

Explain how the story works. You're going to read a story, but there are several different endings. How the story ends will depend upon the choices that the reader makes along the way!

1. Ask the participants to break out into groups (aim to have at least 4 groups, but more is fine. 6–8 participants per group would work well).
2. Give each group a copy of the "Choose your own adventure" story. Allow them enough time to read through the story at least once.
3. Ask someone from each breakout group to read aloud the ending that they reached. Hopefully there will be a few different endings!
4. If the groups reached good or less desirable endings, ask them why they think that happened. What choices did they make, and how did those lead to the ending that they reached? Ask whether everyone in the group agreed on the choices made, or if there were differences of opinion.
5. Allow time for participants to read through the story again, either individually or in groups, to explore how different choices result in different endings.

5. Frequently Asked Questions

OBJECTIVE

Reinforce participants learning about best practices for managing *tabu* areas by directly answering questions that they might have.

Show slides with frequently asked questions (these are questions that the Fiji Locally Managed Marine Area network has been asked by communities previously).

If participants are engaged, you can "test" their knowledge by asking them what they think the answer is, before providing the answers given below (and also in the PowerPoint notes).

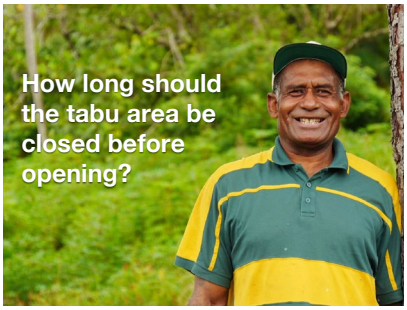
Q: Our harvest was disappointing. Why are there less fish this time?

If the *tabu* area hasn't been closed for long enough between harvests, there will not have been enough time for fish populations to recover. Consequently, there will be less fish in the *tabu* area to harvest. If a community is disappointed by a harvest, they should consider leaving the *tabu* area closed for longer. If frequent harvests are an important objective, it will be necessary to remove fewer fish during each harvest. Fishing effort should also focus on fast growing and abundant species, avoiding large predators (grouper, sweetlips, jacks, jobfish, sharks) and large parrotfish, which take longer to recover.

Another reason for a disappointing harvest might be if there has been poaching within the *tabu* area whilst it should have been closed, or if people have been fishing there by accident because the boundaries are unclear or not well known.

Note that fish stocks will be greater when there is also a permanently closed MPA in the *qoliqoli*.

Q: How long should the *tabu* area be closed as MPA before opening?



How long the *tabu* area needs to be closed for depends upon how heavily fished it is to start with. As a guideline:

If fishing pressure is very light outside the *tabu* area: Close for 1–2 years, then pulse harvest for 1–2 days and reclose

If fishing pressure is very heavy outside the *tabu* area: Close for 3+ years, then pulse harvest for 1–2 days and reclose

If a *tabu* is the only forms of management: close for 3 years. If there are a number of other effective management strategies in place, may be able to open *tabu*s every 1-2 years

Q: Are there certain species (and sizes of certain species) that shouldn't be caught during harvests?

Species that may be protected or subject to trade restrictions (e.g., humphead wrasse) should not be caught during harvests.

Where possible, communities should avoid taking species that are more vulnerable to fishing impacts, as these will take longer to recover. During harvests, seek to avoid:

- Large, predatory species (eg, grouper, sweetlips, jacks, jobfish, sharks)
- Large herbivorous species (eg, big parrotfish)

Large individual fish contribute most to population growth, as bigger fish produce more babies. So, if possible, leave some of the big old fish behind.

The community in Wai*tabu* decided that when they harvested their *tabu*, they would not take species important to reef health, such as Giant Clams (which filter the sea water) and certain surgeonfish (Ika Loa) which control algal overgrowths by feeding on seaweeds, so creating better substrate for new coral growth.

Q: What is the best practice for management of harvests?

How long should they be opened for (e.g. 1-day, 2-days) before closing again, and what suggestion can regulate the take for the opening?

- Decide in advance and enforce a deadline for when fishing will stop, for example, after one or two days of fishing effort, or after a certain number of fish have been caught or a fundraising target achieved
- Leave some fish behind to kick-start recovery for the next harvest
- Aim to harvest no more than 10% of the available fish biomass (if 50% is removed, it might take up to 20 years to recover)
  Wai*tabu* - Fishing limits of 100 kg catch for 2 day openings and 30 kg catch for 1 day openings, fish only
- Ensure that fishing methods used do not damage the coral reef or other fish habitat

The community in Wai*tabu* decided that when they harvested their *tabu*, they would not use destructive fishing methods, so no reef walking, no net fishing and no fishing on compressed air (SCUBA etc.), and limit the size of hooks to avoid targeting small juvenile fish.

Q: How do we know if the *tabu* is working?

Remember that there are different possible objectives for having a *tabu* area, and therefore different possible measures of success. If the *tabu* area is put in place to provide large harvests when required for community events, a good indicator that the *tabu* is "working" to achieve that goal is if the catch during several successive harvests continues to meet expectations.

6. Review

Summarise what has been learnt in this module.

- Decisions about when to open a *tabu* area and how much fish to take will influence management success and sustainability
- Best practices include forming a resource management committee, nominating fish wardens, enforcing the rules
- Short-term benefits are greatest when *tabu* areas are larger, closed for longer and well-enforced
- To maintain benefits over multiple successive harvests, communities must follow best practice for managing harvests, with controls on the amount of fish taken
- To achieve long-term fisheries management and conservation objectives it is best to combine *tabu* areas with complementary management strategies, eg permanent no-take areas, gear restrictions, seasonal closures


Wildlife
Conservation
Society