



Fish smart rules

TIPS AND TOOLS FOR COMMUNITY-BASED FISHERIES MANAGEMENT PRACTITIONERS TO REVIVE FISHING GROUNDS



Pacific
Community
Communauté
du Pacifique

Fisheries management tools for communities



Spawning season bans



No-take areas



minimum size limits



Protecting key habitats



Quotas



Banning harmful fishing methods



Enforcing regulations





INTRODUCTION:

Fisheries management tools for communities





What is fisheries management?

Fisheries management is the process of ensuring that fish and other marine and freshwater resources are harvested in ways that maintain their stocks.

01. Why manage fishers and fish stocks?

Fisheries management is mostly about managing the actions of everyone involved in the catching and harvesting of marine resources so that they are not overfished and continue to provide livelihood benefits (i.e. nutrition, food security and income opportunities).

Pacific Islanders consume up to four times more marine resources than people in other nations and most marine resources are harvested from coastal and inland areas.

The total population of the Pacific Islands is forecast to grow from 12.99 million to close to 20 million, by 2050. Although population growth varies across the region, any increase will cause a concern for food security, particularly with the growing demand for locally caught seafood, so marine resources must be carefully managed to ensure their continued availability.



Overfishing happens when marine resources are taken at rates higher than what can be replenished without management. Simply put, more is taken than what can be replaced through fish reproducing



Governments set rules to ensure that marine resources remain healthy and continue to provide food and income to their citizens.



02. Who manages fisheries?

Government fisheries departments or agencies are mandated to manage the marine resources of each country or territory. Government agencies also provide scientific information to assist in management initiatives, such as the sizes at which different marine resources reproduce.

Communities also play a key role as they often have user and management rights to the marine resources, and broader traditional and local information, such as the locations and times where different marine resources reproduce. They are also witness to the impacts of uncontrolled fishing and harvesting, as well as the recovery of overfished marine resources, when harvesting controls are implemented.

03. Community-based fisheries management (CBFM)

Fisheries management by government departments or agencies often results in fishers feeling excluded when they have not been given the opportunity to effectively participate in the development of restrictions and regulations, they can also be less compliant. Centralised agencies are also challenged with managing community fisheries spread over long coastlines and across many scattered islands over large marine areas.

CBFM allows coastal and island communities to take responsibility for managing their marine resources and the marine environments where these resources are found. CBFM in different forms has been developed in several Pacific Island countries and territories with the assistance of various agencies, research institutions and non-governmental organisations.

With CBFM, the rules and restrictions are often decided by consensus and are more likely to be respected by communities. Acceptance is often backed by traditional and customary structures to which people can relate, or by lower-level government regulations that can be used to formulate CBFM measures. With greater community support and communally made decisions, there is less need for enforcement activities.

However, the lack of legal status can be a problem if community rules cannot be applied to those outside the community. CBFM plans may also lack scientific and technical input, suggesting that CBFM, with the cooperation and collaboration of fisheries departments and agencies, research institutions and non-governmental organisations, is ideal. Called co-management, this describes when all stakeholders work together to manage their marine resources and the surrounding environment.

Communities may find that working with these stakeholders can assist in facilitating the integration of

different voices and interests from within the community, especially from marginalised groups, such as women, youths and people living with disabilities.



04. What controls or management tools can be used to manage fisheries?

Management tools are described throughout this booklet. Communities have always played a pivotal role, such as using long-standing taboos or traditional customs to prevent the overfishing of important species. Communities are often more supportive of these practices as they are familiar with them.



Communities have always played a pivotal role, such as using long-standing taboos or traditional customs to prevent the overfishing of important species



05.

What is this booklet about?

Communities have a greater awareness of the local challenges managing their marine resources, than those outside the community and are accordingly in the best position to decide which management tools are necessary and which ones can be implemented, complied with and enforced.

This booklet describes the tools or actions that can be taken by communities to address their challenges and to ensure their fishing grounds remain productive. Usually, more than one tool or action is required. For example, a common problem is decreasing catches of certain marine resources. To address this problem, a particular community may decide to protect stocks of these marine resources by using temporary closures and to enforce size limits.

Glossary

Scientific terms have only been included when necessary and are defined below.

Biodiversity: the variety of plant and animal life in a particular place or habitat, most desirable at high levels.

Ecosystem: an ecological system that includes all living things and the physical environment with which they interact.

Eutrophication: an overabundance of nutrients in water that results in excessive plant growth, the decomposition of which depletes oxygen and kills aquatic life.

Invertebrates: Animals without backbones, such as crabs, clams, etc.

Overfishing: The situation in which fish and other species are fished so heavily that the numbers caught cannot be replaced by reproduction.

Recruitment: The addition of young to the mature population of a species.

SCUBA: Self-contained underwater breathing apparatus, or aqualungs, used by divers.

Spawning: the process of females releasing eggs and males releasing sperm.

Species: a group of similar individuals capable of interbreeding.

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TEMPORARY CLOSURES:

Spawning season bans

By allowing the fish to first breed, good catches are maintained each year.



Advantages

- Fish who breed predictably at the same time and/or place are ensured a chance to reproduce.



Be careful

- It is preferable that communities vary the timing of the temporarily closed period because spawning events don't always take place at the same time.



When and for which species?

- During the peak spawning months, for fish known to gather in large numbers to reproduce, like **grouper**.
- Several other species known to migrate to spawning aggregation sites: **snapper, emperor, wrasse, parrotfish, surgeonfish and trevally**.



Where?

- Aggregation sites are often at channels in reefs where currents are strong, aiding the transport of fertilised eggs and larvae to distant areas.

1

SPAWNING
SEASONS BANS



What are temporary closures?

Temporary closures are fisheries management tools that involve establishing temporary bans on fishing and harvesting on particular marine resources or on a particular marine environment, or a combination of both, at a given time.

01.

What is the purpose of temporary closures?

Temporary closures are used to protect marine species, especially those about to reproduce; an important use of temporary closures is to allow marine resources the ability to spawn without interference.

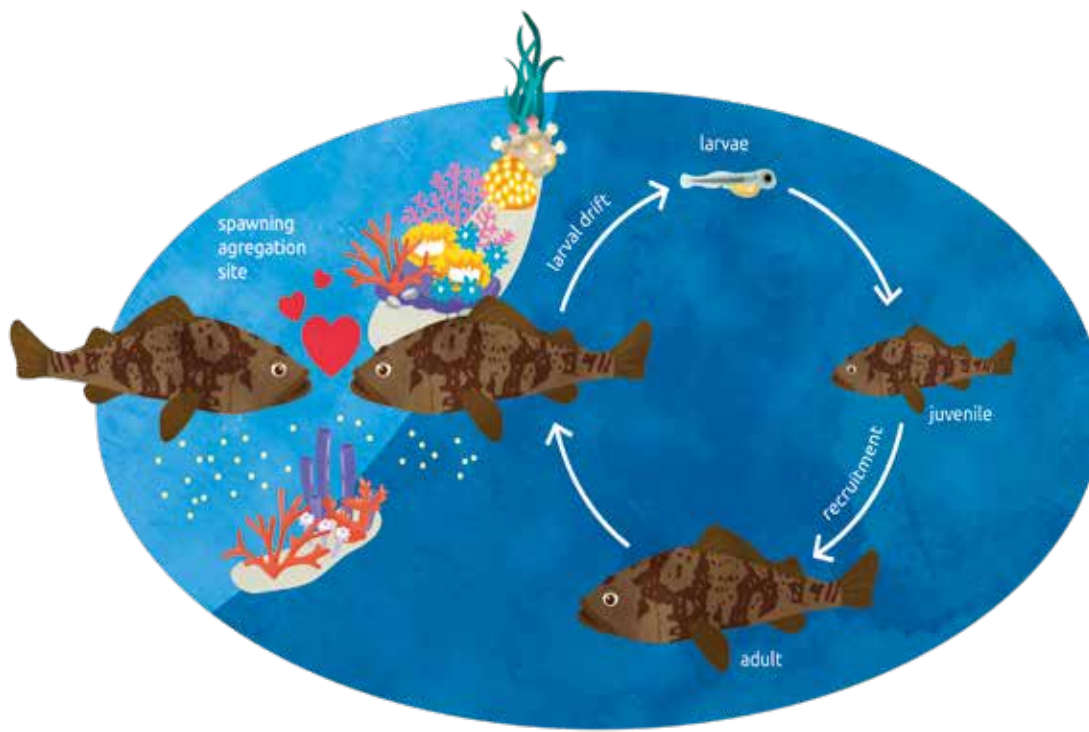
02.

What kind of closures and when & where?

- Spawning season bans to protect key breeding sites and seasons

Many marine resources migrate, often at a particular time of the year, and gather in a well-defined place called a spawning aggregation site. In the figure below, fish gather in a spawning aggregation and the large number of eggs and sperm being released in a relatively small area increases the possibility of the eggs being fertilised.

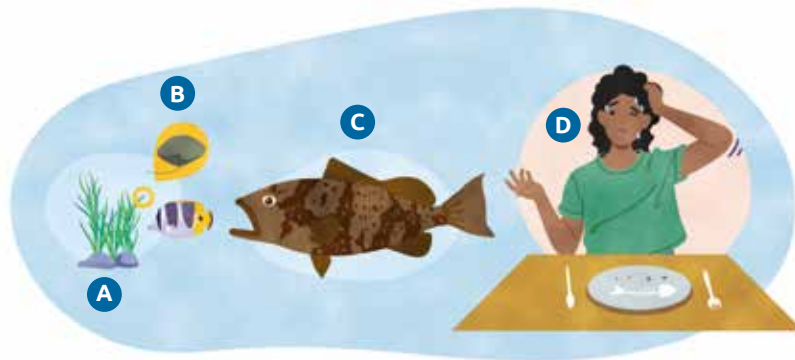
The locations of spawning aggregation sites for different species of fish are often well known to communities and form a part of traditional and local knowledge. Even though these sites may be some distance from the community, they are important to protect, using temporary closures.



Several species are known to migrate to spawning aggregation sites, including grouper, snapper, emperor, wrasse, parrotfish, surgeonfish and trevally. Fish often form aggregations on each new or full moon during the breeding season. The sites are often at channels in reefs where currents are strong, aiding the transport of fertilised eggs and larvae to distant areas.

- Temporary closures to avoid ciguatera fish poisoning

Temporary closures can also be imposed during times when some marine resources become toxic for consumption. One such period is when there is a high risk of people contracting ciguatera fish poisoning, which is responsible for major public health problems in the Pacific region.



Ciguatera is related to the appearance of very small floating plants (phytoplankton) that periodically go through massive increases in abundance, referred to as blooms.

- A** Toxic phytoplankton is associated with seagrass beds.
- B** Increased nutrients (perhaps released from damaged corals) allow toxic phytoplankton to increase in abundance. Toxins are concentrated in small grazing fish.
- C** Carnivorous fish feed on the small fish and the toxins are concentrated further.
- D** People eat affected fish and suffer from ciguatera poisoning.

The seasonal high risk for ciguatera is usually well known to fishing communities and banning particular species during this time is a practical measure.

• Rotational harvesting for marine resources that move minimally

For some marine resources, protection from overfishing can be achieved by rotational harvesting in which different fishing areas are closed and opened on a rotational basis to allow populations and habitats to recover.

A large marine area can be divided into smaller sub-areas that are in rotation each year. If, for example, there are four small areas, each area would have three years' protection allowing populations to rebuild and fish to grow. In the figure to the right, area 1 is open to fishing, while the other three are closed. The following year, area 2 is opened and areas 1, 3 and 4 are closed.

Rotational harvesting is particularly appropriate for marine resources that move minimally, such as some species of reef fish, sea cucumber, sea urchin and mollusc. It may also be less environmentally damaging when areas of fishing grounds are protected and allowed to go through periods of recovery. This can be used on women's fishing areas for molluscs, for example, in which there are temporary closures on some reef flats or mud flat areas of molluscs, but other areas are open. Then the process rotates, and other areas are closed off temporarily to collection.

03.

How can we implement temporary closures?

Communities are aware of the best times and places to establish temporary closures to protect spawning marine resources, as well as the seasons in which some fish become toxic.

In many countries and territories, communities have traditional control over adjacent areas of coast and sea and can ensure that the fishing bans in their

nearby temporary closures are observed. Boundaries and timing of these closures are the responsibility of the community, in wide consultation within the community, and with those that fish within the areas to be temporarily closed, as many people depend on marine resources for food security.

YEAR 1



YEAR 2



Rotational harvesting is particularly appropriate for marine resources that move minimally



The timing of closing fishing and harvesting in a particular area depends on knowledge of the start of the spawning season. This can be determined by observing the reproductive organs or gonads when community members catch and clean marine resources, shown [in the figure below](#). In males, the gonads are pale and thin; in females, the gonads are usually larger and orange. The appearance of large gonads in female fish is a good indication that they are about to spawn.



04.

What are the benefits, problems and limitations of temporary closures?

The benefit of protecting spawning marine resources, and banning fishing and harvesting at spawning times, is to ensure the production of the next generation of marine resources. Problems can include the fact that the start of spawning season varies between different species and may differ from year to year due to environmental fluctuations. It is preferable for communities to have the ability to vary the timing of the temporarily closed period because spawning events don't always take place at the exact same period.

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Several species are known to migrate to spawning aggregation sites, including trevally, emperor, surgeonfish, grouper, snapper, parrotfish and wrasse

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Trevally
Carangidae



Emperor
Lethrinidae



Surgeonfish
Acanthuridae



Grouper
Serranidae



Snapper
Lutjanidae



Parrotfish
Scaridae



Wrasse
Labridae

05.

How do we know that temporary closures are working?

- By protecting spawning adults, the most obvious sign of success is the eventual appearance of large numbers of juveniles. These juveniles can then be protected and allowed to grow by imposing minimum size limits.
- An increased number of men and women fishers are noted respecting the regulation and not fishing or collecting in closed areas.
- If the temporary closure is put in place to avoid ciguatera poisoning, a reduction in the number of community members requiring medical treatment is a reasonable indication of success.
- Temporary closures in particular areas, following rotational harvesting, should result in increased catches.

06.

What other management actions can complement temporary closures?

Strong awareness programmes and enforcement at the community level are required for the success of temporary closures. Observing size limits and avoiding banned species is also important.





PERMANENT CLOSURES:

No-take areas

No-take zones help restock the fishing grounds in nearby areas, that will lead to increased catches.



Advantages

- Help create space for fish to grow and breed.
- Increase marine resource stocks, which will spill over into nearby fished areas.



Be careful

- Small no-take areas will not fully protect fish that swim over large areas; the number of highly mobile fish, such as mullet and trevally, is less likely to increase.



For which species?

- For all species, but particularly for reef fish, such as **parrotfish** and **snapper**, which will increase in numbers even in small, closed areas.



Where?

- Close to communities so that they can be monitored and protected from outsiders.
- In places that include a variety of habitats, needed by fish.
- In a space large enough to meet the movement needs of the target species.



What is a permanent closure?

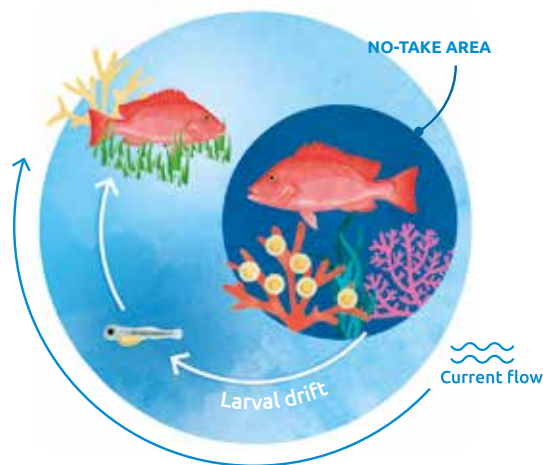
A permanent closure is a fisheries management tool that establishes marine areas where fishing and harvesting of marine resources is permanently banned. It is sometimes also called a fish reserve, marine sanctuary, marine park, tabu area, no-take zone or no-take area.

01.

What is the purpose of a permanent closure?

A permanent closure provides marine resources protection of their habitats, allowing them to reproduce. From the viewpoint of coastal and island communities, the aim of creating a permanent closure is to increase marine resource stocks, which will spill over into fished areas nearby, leading to increased catches.

The movements of marine resources inside and outside an area closed to fishing and harvesting, is shown [↗](#) in the figure below. In this example, the adult fish in the no-take area produce young fish or larvae that drift through the water. Some larvae settle inside the no-take area, while others are carried away by the current and drift outside of it. Juvenile or adult fish may also move out of the closed area in response to increased crowding and competition.



02.

When and where should permanent closures be used?

A permanent closure is a management tool to be considered when catches of specific marine resources have been decreasing. It is important to check whether the main species of concern are likely to benefit from a permanent closure ([see species information sheets](#)) or another management tool, such as a temporary closure. It is also important to consider how the marine resources are used by different individuals. It may be that one group, such as women fishers, will be more affected by a closure than other fishers and so their views and support should be sought.

Ideally, the closure should be positioned close to the community so that it can easily be monitored and protected from outsiders. [↗](#) In the figure above, a community has set up a closure in which fishing has been banned within its managed area. The no-take area should include a range of habitats such as coral reefs, seagrass and mangroves, which will benefit a variety of different species. In this example, the closed area is positioned so that the prevailing current flow is likely to distribute larvae and displaced fish into the fished area adjacent to the community.



The closed area should include a range of habitats such as coral reefs, seagrass and mangroves



03.

How can we implement a permanent closure?

Permanent closures are preferably established and maintained by the communities themselves, as they have the most to gain. In some Pacific Island countries and territories, communities have control over the adjacent areas of coast and sea and can ensure that fishing bans in their closed areas are observed.

All members of the community must be involved in declaring a permanent closure to ensure awareness by all. The community bears the responsibility to mark the boundaries of the closed area with wooden stakes or buoys so that the area is clearly indicated. It also has the responsibility to enforce the permanent closure and penalise anyone breaking the community rules on fishing and harvesting.

Some countries and territories have open access fisheries in which there are no limits to where people can fish. In these cases, communities must be given the means to declare and maintain closed areas.



The expected increase in the numbers of marine resources is not uniform across all species.



04.

What are the benefits, problems and limitations of permanent closures?

Despite the positive effects of declaring permanent closures, some closed areas fail because they have not been established in suitable locations. Permanent closures positioned in areas of bare sand or coral rubble, for example, are unlikely to be successful as these are unsuitable habitats for most marine resources. Permanent closures are best declared in areas that include a variety of habitats and are sufficiently close to the community for their protection.

In a previously depleted area, it may take months, years or even decades for the numbers of marine resources to increase after the permanent closure has been declared. In this case, people in the community may tire of waiting for results and resent the imposition of the closed area.

- › The increase in the numbers of marine resources is also not uniform across all species:
 - Reef fish, such as parrotfish and snapper numbers may increase even in small, closed areas.
 - Highly mobile fish, such as mullet and trevally, are less likely to increase.
 - Among the invertebrates, faster growing species, such as trochus and small clams, appear to show greater recovery in closed areas than slower growing species, such as giant clams.
- › Different fish species have varying ranges over which they move to feed; ideally the size of the closed area should be based on the local knowledge of the species.

Sometimes communities are tempted to open their permanent closure when they observe an increased number of marine resources for community celebrations; this defeats the original purpose of the permanent closure.

Although communities can often prevent their people from fishing in its declared permanent closure, it may be more difficult to prevent fishers from other communities from doing so. In this case, communities may need additional support from fisheries departments, agencies or the police for enforcement. In some cases, communities can use by-laws or community regulations which would allow offences to be punishable by law.

A community-owned and managed closed area requires resources, including labour and materials to mark area boundaries, and to enforce the fishing ban.

A permanent closure that is too large may deprive some people, particularly the elderly and women fishers, from catching their daily food. For this reason, it is necessary community members be involved in decisions in establishing the position and size of the closed area.

05.

How do we know that a permanent closure is working?

The first obvious sign that a permanent closure is working may be by the simple observation of an increase of marine resource populations by community members, called perception-based monitoring.

There are more technical ways of determining increases in marine resources in a permanent closure. An underwater visual census (UVC) involves community members swimming in a straight line in several places across the permanent closure (wearing a mask and snorkel) and counting the number of marine resources of different species in a track of about five metres wide. The surveys can be kept simple by restricting observations to just five or six species. Surveys should be repeated at monthly intervals and the records of results kept and reported at community meetings.

UVC is especially appropriate if the community has external support to supply masks and snorkels and train young community volunteers to undertake these UVC transects across their permanent closure and then compare the results with those in unprotected areas.



06.

What other management actions can complement a permanent closure?

Strong enforcement of bans on fishing and harvesting in the permanent closure area is necessary and particular community members are usually assigned to carry out this task. Protecting marine resources during their spawning season and enforcing size limits will also assist to increase the populations of these marine resources in other remaining areas of your fishing grounds. The fishing and harvesting of some marine resources are prohibited under national laws or regulations. These species require protection whether they are in a permanent closure or an unprotected area. Examples of these are humphead wrasse and bumphead parrotfish.

Communities may want to consider allowing fee-paying tourists to visit their well-preserved areas of corals and reef fish. While this generates income for the community, visitors should keep to marked tracks or snorkelling trails to avoid habitat damage.





LIMITS ON CATCHING SELECTED SPECIES, INCLUDING

minimum size limits

Minimum size limits ensure that the targeted species have a chance to grow and reproduce before being caught.



Advantages

- Allow fish and invertebrates to grow to a size at which they can spawn at least once before capture.



For which species?

- Preferably for fish or invertebrates that are not harmed by the catching method and whose size can easily be gauged.



Be careful

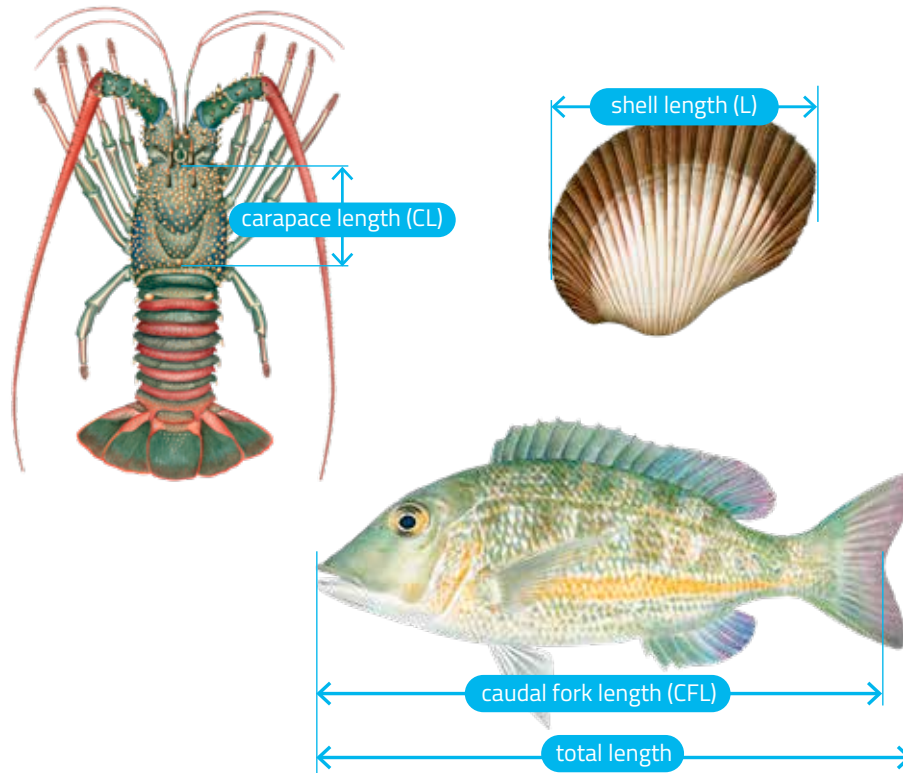
- Not recommended for fish that change sex during their lives, such as groupers and emperors. In these species, the application of minimum sizes may concentrate fishing pressure on one sex.





What are size limits and species bans?

- Size limits are a fisheries management tool used to delimit the sizes at which fish or invertebrates can be caught.
- Species bans are a fisheries management tool that prohibits the catching and retaining of selected species.



01. What is the purpose of size limits and species bans?

- The reason for the application of minimum size limits is to allow individual species to grow to a size at which they can spawn at least once before capture.
- Banning the catching of selected species is aimed at protecting those that are under threat or endangered, usually from excessive fishing.

02. When and where should we use size limits and bans?

Size limits have been applied by fisheries departments or agencies in most Pacific Island countries and territories to a wide range of species of inshore pelagic fish, reef fish, sea cucumber, clam, trochus, green snail, crab and lobster. These size limits and bans should be publicised and respected by communities as well as commercial fishers.

Different countries may have different ways of measuring marine resources. Standard length measurements are shown in the accompanying figure for various groups of marine species. From left, clockwise: carapace length (CL) of a lobster; shell length (L) of a clam; and either total length (TL) or caudal fork length (CFL) of a fish.

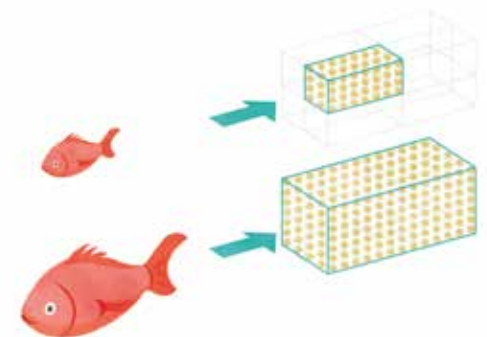
Size limits and other coastal fisheries regulations in the Pacific region are summarised on the Reeflex webpage, hosted by SPC:

<https://www.spc.int/CoastalFisheries/Legislation/>

For some species, an upper size limit has been applied in addition to a minimum size limit. This is usually justified on the grounds that larger individuals produce a disproportionately greater number of eggs than smaller individuals.

The figure below shows a younger female fish. When a fish doubles in size — depth, width and length, its volume increases eight times; and as egg carrying capacity is related to volume, the number of eggs also potentially increases by eight.

Upper size limits may also be applied in cases where larger individuals are less marketable than smaller individuals. Large trochus shells, for example, which are often pitted due to a lifetime of parasitic attack, are of less use in the manufacture of pearl-shell buttons.



03.

How do we implement size limits and bans?

Size limits

If fisheries departments or agencies are setting fishing regulations that are science-based and imposed with the best of intentions, it is in the interest of communities to support these regulations. Communities should raise local awareness of the need for size limits and bans and monitor catches made by community members.



Species bans

- Communities can implement bans on catching particular species that are overfished or vital for the health of reef areas. For example, parrotfish keep corals clear of algae, which would otherwise smother and die. In some communities, the introduction of underwater torches has allowed fishers to dive and spear parrotfish at night, while the fish sleep under coral ledges.

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In many lagoons, parrotfish have been completely overfished and coral growths have been badly affected. Some communities have accordingly banned this method of night fishing.

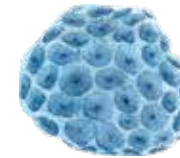
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- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has established a worldwide system of controls on the international trade of some threatened marine species. Those of interest in Pacific Island countries and territories include: all species of giant clams (*Tridacna*), corals, all sharks and the humphead wrasse (*Cheilinus undulatus*); and some species of sea cucumbers (black teatfish, *Holothuria whitmaei* and white teatfish, *Holothuria fuscogilva*).

- Giant clams live in clear shallow water that make them particularly vulnerable and some species have disappeared from many Pacific Island countries and territories. Public awareness is needed to ensure that fishers are familiar with protected species.



Corals



Giant clam



Shark



Napoleon wrasse



Sea cucumbers

04.

What are the benefits, problems and limitations of size limits and bans?

The benefits of applying size limits and bans on threatened species are to ensure that populations of these marine species thrive and provide a continuing supply of seafood for the communities.

- **Size limits should be easily gauged**

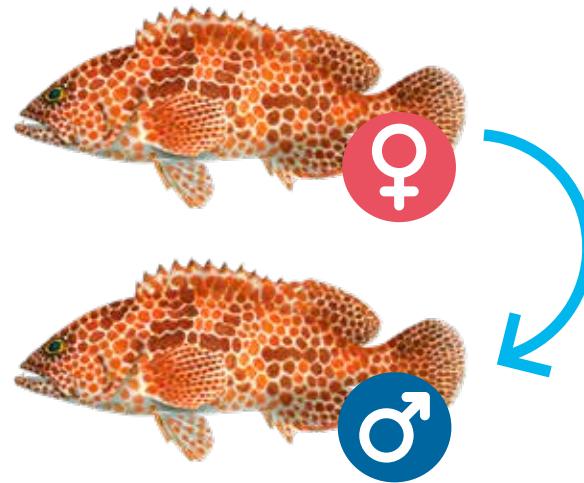
One of the problems of size limits is the difficulty communities face in determining the size of particular marine resources that are caught and harvested. In Fiji, the size limit of 3 cm on ark clams is allowed to be measured by using the fisher's fingers.

- **Fish or invertebrates should not be harmed by the catching method**

Minimum size limits are only applicable when the marine resources caught or harvested are not harmed by the catching method, such as molluscs gathered by hand, or crustaceans caught in traps. As speared undersize lobsters would not survive if released, fishers have become adept at judging their size to avoid spearing small individuals. Although some shallow-water, undersize fish caught on hooks may survive well if returned to the water immediately, this type of regulation is inappropriate to apply to fish such as deepwater snappers. The probability of fish surviving being hauled to the surface from deep water and released are small. The resulting reduction in pressure inflates swim bladders, keeping released fish afloat.

- **Not recommended for fish that change sex during their lives**

The life history of tropical reef fishes can also complicate the use of minimum size limits. Many tropical reef fishes such as grouper and emperor change sex during their lives. In these species, the application of minimum sizes may concentrate fishing pressure on one sex. If males grow to a certain size before becoming larger females, most of the legally sized fish in the catch will be female. Some species of groupers, for example, grow to 3 kg before becoming female. On the other hand, some groupers, such as the coral trout, change from females to larger males. In this case, most of the total catch are likely to be males. The removal of too many males could result in an insufficient number of males to fertilise eggs during spawning. To overcome these problems, the implementation of maximum size limits may also be considered for some species.



05.

How do we know if size limits and bans are working?

Communities should undertake surveys of the marine resources they catch and harvest to reveal if undersized fish and banned species are being caught. If they are, community members, with the support of their traditional leaders, should take locally appropriate action to reprimand offenders.

06.

What other management actions can complement applying size limits and bans?

Protecting females bearing eggs is another way of maximising the contribution to the next generation. However, regulations protecting females can only be applied sensibly to species in which the sex can be distinguished easily by fishers and where the catching method does not harm the individuals caught. The sex of most fish cannot be determined by external examination, and other regulations, such as the application of closed seasons during the spawning period, may have to be considered as alternatives.

In most crustaceans, the sex is easily distinguishable, and regulations making it illegal to capture and keep lobsters and crabs bearing eggs can be put in place.



spawning season bans



Protecting females bearing eggs is another way of maximising the contribution to the next generation





PROTECTING MARINE ECOSYSTEMS:

Protecting key habitats

Fish and invertebrates are dependent on their habitats such as corals, mangroves, seagrass beds. Protecting these habitats is then as essential as protecting the species they support.



Advantages

- Fish and invertebrates thrive in a rich environment, allowing better catches.



How?

Examples:

- Ban the smashing of corals to catch sheltering marine resources.
- Ban the cutting of mangroves.
- Close areas of seagrass beds to fishing and harvesting.
- Ban the dumping of waste and rubbish in the mouths of rivers.



Be careful

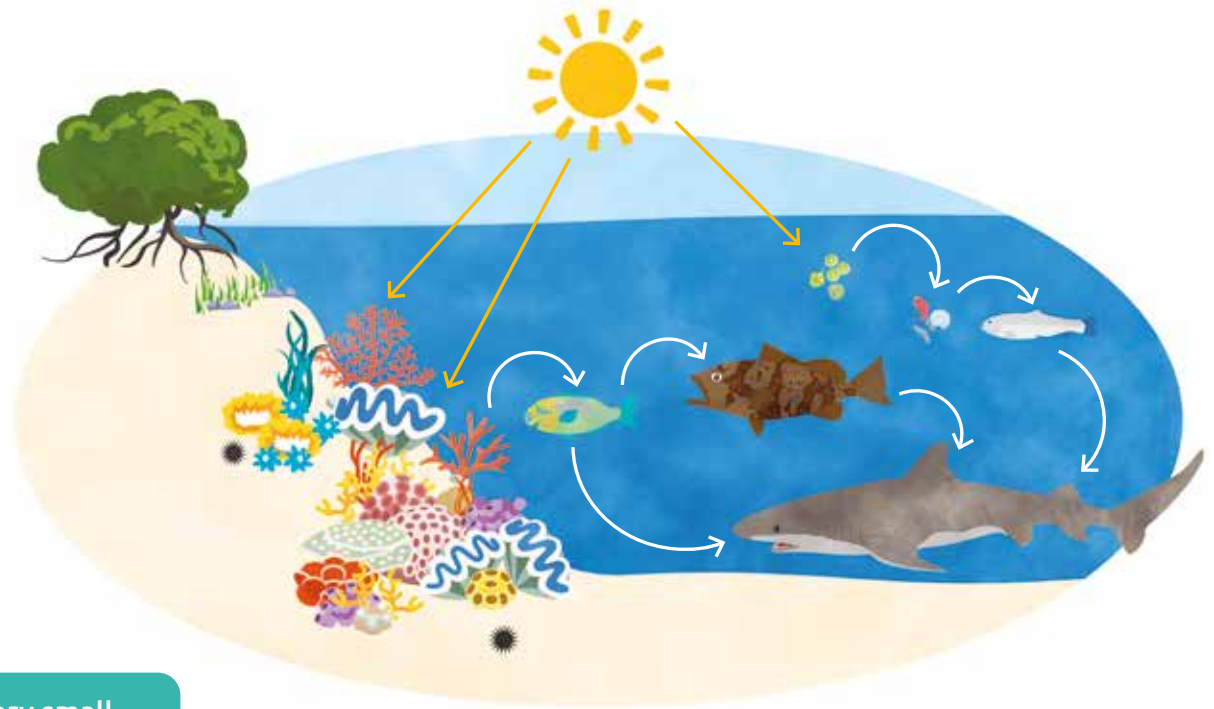
If marine ecosystems are being affected by silt or other materials, local community action will have little effect without government involvement.



What are marine ecosystems?

Marine resources do not exist in isolation. They are part of a complex system called a marine ecosystem, which consists of all living things such as fish, corals and seaweed and non-living things such as the sea water and sand with which they interact. Humans are also part of the marine ecosystem.

Sunlight is used by very small drifting plants (phytoplankton) which are grazed on by small drifting animals (zooplankton). Larger plants and some animals such as corals and giant clams use sunlight to create tissue which is used by plant eaters, including rabbitfish. Other animals feed on the plant eaters so that food moves through the ecosystem and supports a huge array of living things as indicated in the figure above.



01. What is the purpose of protecting marine ecosystems?

Each species exists in a balance with the species that feed on it (its predators) and the one that it feeds on (its prey). There's no point in protecting marine resources without protecting the marine ecosystems and habitats in which they live, including coral reefs, mangroves, seagrass beds and estuaries.

02.

When and where should we protect ecosystems?

A survey, completed by Fisheries authorities in Pacific Island countries and territories, captured the negative effects of non-fisheries activities on the marine environment, including reclamation, siltation, waste disposal, eutrophication (depleted oxygen), pollution and the inadequate treatment of effluent. All of these can affect food webs and key habitats, such as nursery and spawning areas.

Threats and possible remedial actions are detailed below under the headings of the key ecosystems of coral reefs, mangrove areas, seagrass areas and estuaries.

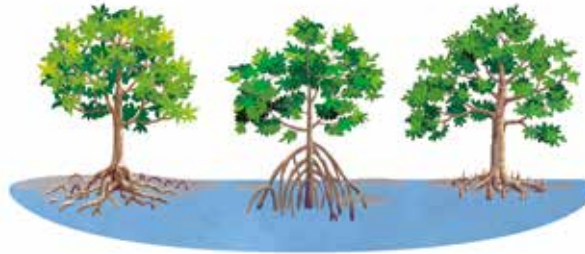
- **Coral reefs** are one of the most productive ecosystems in the world and support a wide range of species, including corals, worms, crabs and fishes. Damage occurs by using destructive fishing methods, siltation and the overgrowth of algae due to the presence of excessive nutrients.



An important step to improve water quality and marine ecosystem health is in reducing the amount of effluent from sewage systems and piggeries. The addition of these nutrients can result in eutrophication (low levels of dissolved oxygen) and kill fish in lagoon waters. Nutrient-using plants, such as bananas, can be planted near the drains or outflows from sewage systems and piggeries.

Traditional destructive fishing methods, such as the smashing of corals to catch sheltering marine resources, should be banned as should the collection of corals for building materials.

- **Mangrove areas** are trees or shrubs that grow at the edge of the sea. As well as protecting shores from erosion, they provide food and shelter for many marine resources.



Community actions could include the banning of cutting mangroves for firewood and structures. The establishment of rubbish dumps in mangrove areas should be banned.

In some cases, mangrove areas have been destroyed indirectly by the construction of coastal roads. Unless large pipes are placed beneath the road, mangroves on the seaward side of the road die in water that is too saline and those on the landward side die in water that is too fresh.

In many countries and territories, the demand for living space is high and coastal areas are under increasing threat. Many coastal wetlands and mangrove areas have been destroyed and converted to dry land for coastal development purposes.

There have been several attempts to re-establish lost areas of mangroves by planting seedlings. However, the reason for their original loss needs to be established and addressed before replanting.

- **Seagrass areas** form underwater meadows and provide essential habitats for many marine resources. Communities could close areas of seagrass beds to fishing and harvesting to create seagrass reserves.



- **Estuaries** occur where rivers meet the ocean. Here the water is often brackish due to sea water mixing with fresh water. Estuaries support a range of species such as crabs, prawns and the juveniles of many fishes.

Communities could ban the dumping of waste and rubbish in the mouths of rivers. Preventing the establishment of houses and farms close to the banks of rivers would also reduce silt and effluents entering rivers and estuaries.

Besides being unsightly, discarded packaging, typically plastic and polystyrene, can be harmful to marine species. Large fish and turtles often mistake litter for food then choke, as an example, on plastic bags, which resemble jellyfish.

03.

How can we implement the protection of marine ecosystems?

Considering the degradation of ecosystems, fisheries managers are now taking a broader approach that attempts to manage fish habitats and ecosystems. This implies that non-fisheries activities impacting marine ecosystems must also be managed, particularly by communities.

Most marine ecosystems are under the mandate of multiple government departments and there should be an attempt to ensure that there is a coordinated approach to sustainable development and management of ecosystems.

04.

What are the benefits, problems and limitations in protecting ecosystems?

Local actions to protect marine ecosystems are often very effective. However, actions taken at the community level may not address the problems caused by sources of silt and pollution from activities further away, including forestry, sand mining and reclamation. If the marine ecosystems are being affected by silt or other materials from one of these sources, the actions of local communities will have little effect without government involvement and cooperation.

Collaborative efforts are needed by the different government departments responsible for forestry, agriculture, fisheries and climate change to work together to address the sources of degradation of marine ecosystems. An ecosystem approach to fisheries management can ensure that sources of pollution, siltation and other land-based activities, are considered.



Fisheries departments, agencies or communities could appoint a number of local people as community wardens to monitor actions required to protect their marine ecosystems



05.

How do we know if protecting marine ecosystems is working?

Fisheries departments, agencies or communities could appoint a number of local people as community wardens to monitor actions required to protect their marine ecosystems. Local schools could also be involved in their monitoring and reporting on community actions taken.

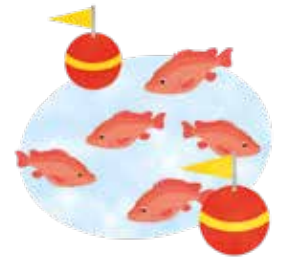
06.

What other management tools can be used to complement the protection of ecosystems?

Other methods of protecting marine ecosystems include the declaration of permanent closures.

Closures can be declared to protect mangrove and seagrass areas as well as coral reefs, but these only work with the participation of communities, especially fishers, both men and women.

Fishing on critical species which ensure the health of corals, such as parrotfish, should be reduced.



no-take areas



LIMITS ON THE AMOUNT OF FISHING AND HARVESTING:

Quotas

Limiting the volume of marine resources caught by each fisher allows for better shareability of a limited resource within a community.



Advantages

- Enough fish or invertebrates remain in the water to reproduce and replace those caught each year.



Where and how?

- Ban commercial fishing and harvesting in inshore areas.
- Limit the quantity of marine resources caught by each fisher.



Be careful

- Particularly difficult to enforce if there are external fishers or licensed commercial fishers in an area.



What are limits on the amount of fishing and harvesting?

Limits on the amount of fishing and harvesting are often called bag limits or quotas.

These are usually daily restrictions on the number or weight of specific marine resources that fishers are allowed to catch. In some fisheries in Pacific Island countries and territories where large quantities of fish are caught for sale, fishing and harvesting is controlled by the issuance of commercial fishing licenses.

01.

What is the purpose of limits on fishing and harvesting?

Human populations are increasing, while fish populations are decreasing. Limiting the number of marine resources caught by fishers allows the limited stock to be shared by more people. It is also important that enough marine resources remain in the water to reproduce and replace the numbers caught each year.



02.

When and where should we use limits on the amount of fishing and harvesting?

Community-imposed limits can include banning commercial fishing and harvesting in inshore areas and limiting the number of marine resources caught by communities.

03.

How can we implement limits on the amount of fishing and harvesting?

The first task of communities is to convince their members, with the support of community leaders, that limits on the amount of marine resources caught or harvested are necessary and that it is in the interest of everyone to support community-imposed regulations. The community should appoint people to raise local awareness on the need for limits and to monitor catches made by community members. Where people are entirely reliant on fisheries resources for food and income, catches of only particularly vulnerable species could be controlled.

There should exist community-based fisheries management committees responsible for building awareness, implementation and monitoring. Limiting catches or putting quotas on catches of certain species requires wide-ranging consultations with all community members. Limiting catches can be particularly difficult if there are external fishers and licensed commercial fishers in an area.



Limiting catches can be particularly difficult if there are external fishers and licensed commercial fishers in an area



04.

What are the benefits, problems and limitations of limiting the amount of fishing and harvesting?

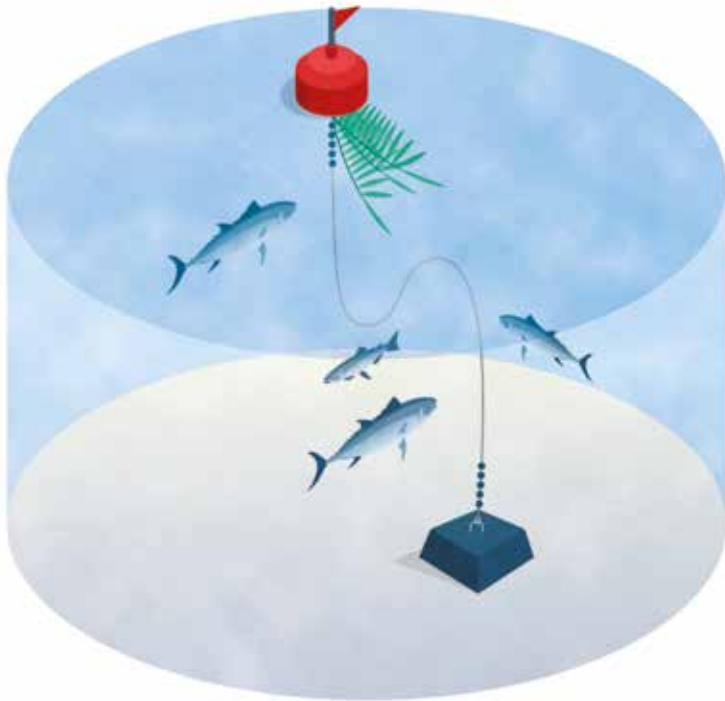
Limiting the amount of fishing and harvesting by communities benefits all members in sharing limited marine resources. However, this may be resented by communities and many fishers may have the habit of selling excess catches for additional revenue. Community leaders will have the difficult task of convincing people that limitations are necessary for the good of all community members.



05.

How do we know if fishers are complying with limits on the amounts of fishing and harvesting?

Community leaders can assign people to conduct surveys at landing sites to determine if community-based restrictions are being observed. Fisheries departments or agencies may need to train local people in taking creel surveys and recording landings as men and women return from fishing.



“

Some communities have reduced the amount of fishing on over-exploited inshore reef species by deploying FADs offshore.

”

06.

What other management actions can complement limits on the amount of fishing?

Restricting the use of highly effective fishing gear will also assist in making marine resources available to the community in the long term and for future generations.

Fish aggregating devices (FADs)

Many species of fish that inhabit the open sea are attracted to floating objects. This behaviour has been used in the deployment of fish FADs, floating rafts anchored offshore to attract pelagic fish. A range of materials, including bamboo, have been used in the construction of rafts. Other aggregating materials such as old fish nets, palm fronds and old biodegradable ropes are suspended beneath the rafts to increase the raft's effectiveness as a habitat for fish.

Some communities have reduced the amount of fishing on over-exploited inshore reef species by deploying FADs offshore. This allows fishers to catch pelagic species such as tuna, wahoo, rainbow runner and mackerel. Moving fishing efforts from coastal habitats to offshore fishing may reduce pressure on inshore species, including reef fish, crustaceans, molluscs and sea cucumber and potentially allow their numbers to increase.

However, mooring FADs in depths of over 1000 m is difficult. The cost of building and setting FADs is high and, because of storms, wear and vandalism, their average lifespan is often less than 12 months. This usually means that aid or financial support from governments is required to build and install FADs.



Banning harmful fishing methods



LIMITS ON FISHING GEAR AND METHODS:

Banning harmful fishing methods

As human populations increase and fish populations decrease, some highly efficient fishing methods leave too few fish behind.



Advantages

- Enough fish or invertebrates are left in the water to reproduce and replace those caught each year.



Where and how?

- Ban destructive fishing methods: using explosives and damaging corals with derris root or crow bars.
- Control the use of or ban highly efficient fishing methods.

Examples:

- Ban small size nets
- Ban night spearfishing with a torch
- Limit the number of beach seine nets allowed and ban their use in particular areas or seasons
- Limit the number of fish traps and fish weirs used in a specific zone
- Ban the breaking of corals



01.

What is the purpose of limits on fishing gear and methods?

Many types of fishing and harvesting results in large numbers of specific marine resources being caught or harvested. The increasing use of such fishing and harvesting methods will decrease the number of marine resources available for food for communities and left to reproduce to sustain stock. Previously, when human populations were smaller, the use of overly effective fishing gear may have had little effect, but with increasing populations, limits on the way marine resources are caught or harvested are now increasingly necessary.

Destructive fishing methods, such as the use of explosives and damaging corals with deris root or crow bars can make reefs unproductive for many years. It is always important that enough marine resources remain to reproduce and replace the numbers caught and harvested each year.



Problems occurs when fishing gears catch many fish of all sizes and sometimes entire schools of fish



02.

When and where should we have limits on fishing gear and methods?

Community-imposed restrictions can involve banning commercial fishing in coastal habitats and controlling the use of highly efficient fishing gear by communities. The use of underwater breathing devices (e.g. SCUBA or hookah) has been banned in many countries.

Other commonly used gear includes gill nets, beach seine nets, cast nets, fish traps, fish weirs, fish baskets and gleaning. Problems occurs when these gears catch many fish of all sizes and sometimes entire schools of fish.

- A [gill net](#) is a panel of netting held vertically in the water by a series of floats attached to its upper edge and weights attached to its lower edge, as shown [in the figure below](#). The strands of the gill net lock behind the gills of fish trying to pass through them. These nets often have a minimum mesh size mandated by fisheries authorities and are usually anchored in shallow water.



What are limits on fishing gear and methods?

Limits on fishing gear and methods involves restricting fishing and harvesting to specific methods, including banning those that are destructive.

- A **beach seine** net is a panel of mesh netting, sometimes with a bag or section of loose netting in the middle of the net. The top of the net has floats and the bottom has a series of weights. The head and ground line ropes extend past the mesh to either a wooden pole or triangular bridles used to tow the seine net to the beach. Nets of up to 50 metres in length, deployed from a small boat or by wading, are used to surround schools of fish.



a beach seine net

- **Fish traps and weirs** use the ebbing tide to strand fish in areas hollowed out on reefs and sandbanks and are then contained by V-shaped or semi-circular walls of stone or coral. Fish traps and fish weirs are usually built at right-angles from shorelines and reefs to guide migrating coastal fish such as mullet into a large retaining area. Their ease of construction and the demand for their use by growing populations has resulted in some coastal areas having many fish traps or fish weirs separated by short distances.

- The harvesting of marine resources by **gleaning** is a common and often social activity that is an important source of food, particularly when the sea is too rough to catch or harvest marine resources in deeper waters. Gleaning is often practised by women fishers who need to remain close to home and who collect algae, sea urchin, sea cucumber and octopus from nearby reef flats.

Destructive fishing methods include the use of explosives and poisons to disable and capture fish. These include the use of derris roots and commercially available poisons such as bleach and cyanide as well as explosives. Poisonous plant materials are traditionally used to catch fish in many Pacific Islands. Derris root is derived from the roots of the climbing vine, *Derris elliptica*, and the nut of the coastal tree, *Barringtonia asiatica*.

More seriously, commercial poisons are poured into pools, isolated at low tide, to capture marine resources that become trapped when the tide recedes.



a fish weir

03.

How can we implement limits on fishing gear and methods?

Gill nets with regulated minimum mesh sizes, may allow small fish to escape. However, if the nets are not held taut, the netting sags and becomes tangled and then catches many small fish. This practice is hard to police and is best addressed by appealing to communities to respect minimum mesh sizes, keep nets stretched taut and return unwanted fish to the sea.

Beach seine nets, particularly those with small mesh sizes, catch everything in their path. Community restrictions can include limiting the number of nets allowed and banning their use in particular areas or seasons.

Fish traps and fish weirs are very effective in catching fish migrating along shorelines. Some communities have limited the number of fish traps and fish weirs used in their fishing areas.

Gleaning from the same area each day results in damage to reefs and corals. The combined impact of many people gleaning can be substantial. Some aspects of gleaning, such as the breaking of corals, should be banned.

Banning the use of destructive fishing methods requires local community-based action as these methods represent a serious threat to marine ecosystems and the long-term availability of seafood in communities.

Education and publicity campaigns are required to educate communities on the impacts of destructive fishing and harvesting methods and may be the best way of reducing the use of these destructive ways of fishing.

04.

What are the benefits, problems and limitations of limits on fishing gear and methods?

A benefit to communities controlling the use of overly efficient fishing gears is that they better allow marine resources to be shared by all community members. More importantly, these restrictions may allow enough marine resources to remain in the water to reproduce and replace the numbers caught each year. Problems relate to the difficulty in controlling the use of these fishing gears.

Although the use of chemicals and explosives may be illegal under national laws, the practice may be tolerated in isolated communities in which the illegally caught fish are shared.



These restrictions may allow enough marine resources to remain in the water to reproduce and replace the numbers caught each year.



When you want a coconut, you don't chop down the whole tree !



So, when you want a fish, DON'T kill the whole reef

People who use dynamite and chemicals to kill fish are destroying our reefs. They are also destroying our future.

05.

How do we know if limits on fishing gear and methods are working?

Local people, nominated by community leaders, monitoring the use of fishing gears, see an increase of action taken against offenders. Offenders caught using destructive fishing involving explosives and poisons are disciplined in line with local norms or penalised under relevant government regulations.

06.

What other management actions can complement limits on fishing gear and methods?



rotational harvesting

Rotational harvesting (temporary closure) is an example where a large gleaning area can be divided into smaller sub-areas that are alternately opened or closed.



Enforcing regulations



What is marine resources enforcement?

Enforcement is the execution of processes to ensure compliance with laws, rules or obligations that provides communities continued access to their marine resources.

Enforcement includes ensuring that the rules are understood by all community members.

01.

What is the purpose of marine resources enforcement?

If community members have not been involved in the development of marine resource rules, some might ignore them, others might not even be aware of them. Community involvement, understanding and enforcement are necessary to ensure healthy and sustainable fisheries for present and future generations.

02.

When and where should we use enforcement?

All Pacific Island countries and territories generally have one or more government agencies that are responsible for managing their coastal zones and marine resources and legislation designed to protect various marine resources. However, government fisheries departments and agencies find it difficult to enforce regulations in communities that are distributed over large marine territories. For these reasons, communities themselves must support and enforce sensible government regulations, and also make their own community rules to protect their marine resources.

It is in the government's interest to empower communities to manage their marine resources and engage communities in national decisions on fishing rules to encourage compliance and enforcement support.



03.

How can we implement the enforcement of regulations?

Under community-based fisheries management, communities, in collaboration with the government, accept responsibility for imposing and enforcing their own controls on their marine resources as well as ensuring compliance with existing national laws.

In communities with a direct interest in the success of the management of their marine resources, compliance with controls on fishing and harvesting may be high. Many communities actively enforce their own rules, and often apply severe penalties, including traditional fines for infringements. The best way of ensuring controls are respected and followed is through the participation of all community members, publicity and education. Existing community meetings should include items on prohibitions and rules relating to the management of marine resources and the marine environment.

To ensure full participation, it is important to involve youths and women in making community decisions as they are both fishers and resource users. Women are more likely to have a longer term and intergenerational view relating to the management of marine resources. For example, women collecting sea grapes (*Caulerpa* spp.) habitually place some of their catch back into nearby reef crevices where they grow and provide future food. The education of children is important even if results are long-term.

Community rules must be made known, not only to community members, but also those from neighbouring communities, as well as visitors. It is also beneficial to involve these

neighbouring communities in the process of making community rules. Visible signs can be used to indicate reserves that highly regulate the catching or harvesting of marine resources. Although prosecution should be regarded as a measure of last resort, necessary regulations must be rigorously enforced. Ideally the best strategy is not so much in enforcing the rules, but in convincing community members that they are necessary.



sea grapes (*Caulerpa* spp.)

04.

What are the benefits, problems and limitations of enforcing regulations?

Enforcing measures to protect populations of marine resources and their habitats ensures that fish catches remain sustainable and continue to provide food for local communities. If governments set fishing regulations that are evidence-based and imposed for the best of intentions, these should be supported and enforced by community members.

Problems can occur in cases where community leaders impose rules that restrict fishing methods or the numbers and types of fish caught. The task of convincing the community that the rules are necessary is a difficult one. The most effective way of ensuring that rules are respected is by involving all community members, including youths and women, in the establishment of rules and through education.



To ensure full participation, it is important to involve youths and women in making community decisions as they are both fishers and resource users



05.

How do we know if regulation enforcement is working?

The main indication of success is an increased number of community members that are aware of the existence of the rules, and accept and comply with them. Communities can assign respected members of the community as wardens, or stewards, to monitor understanding and compliance.



06.

What other issues must be considered?

All tools described in this booklet must be applied considering the projected impacts of climate change. For example, rising sea temperatures can alter the time of year when coral reef fishes spawn, which would then alter the timing of bans, so would require flexibility to change annually.

Fish habitats will also be affected. Warmer seas will continue to produce more episodes of coral bleaching, caused by the loss of the tiny plants living within the coral tissue. Carbon dioxide in the atmosphere is also increasing. As more of it dissolves into the ocean, the water becomes increasingly acidic, making it harder for

species of corals and molluscs, which need calcium carbonate, to build their skeletons and shells.

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EUROPEAN UNION

