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Fisheries Management

By

**Mike King, Lyn Lambeth, Samasoni Sauni,
Joeli Veitayaki, Veikila Vuki, Aliti Vunisea,
and Tony Chamberlain**

Community Fisheries Training Pacific Series 8
USP Marine Studies Programme/ SPC Coastal Fisheries Programme:
Training Materials for Pacific Community Fisheries



The University of the South Pacific



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NZODA



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Preface to the Series

The majority of Pacific Island countries rely on the sea as a major source of food. While women are not involved in offshore deep sea fishing, they are active in collecting and gleaning shellfish and other edible sea species from the nearshore areas and inside the reef. Women also prepare fish either for sale or home consumption. In this preparation process, women are involved in cleaning, gutting, cooking and selling various seafoods. In many atoll countries, women are also involved in the preservation of seafood by drying or smoking. In view of women's role in fisheries activities and the importance of seafood in the region, it is vital that women learn not only the correct handling methods for seafood, but also how to use marine resources wisely for the future.

This manual is part of the Community Fisheries Training Series, and is designed to meet the wide need for community fisheries training in the Pacific, particularly for women. The series was originally developed for the SPC Community Education Training Centre (CETC). The fisheries course at CETC began in 1999 as a joint effort with the USP Marine Studies Programme. It was a response by the Centre to meet the needs of women in the region to improve their skills in small-scale fisheries activities. The USP Post Harvest Fisheries Project was also working to provide post harvest fisheries training for men and women in the region, hence the joint venture between the two institutions in 1999. The two groups of women who have since been through the course have found the training interesting and useful.

Since its inception in 1999, the course has been taught jointly by the USP Marine Studies Programme staff in Fiji Islands and the SPC Community Fisheries Section staff based in New Caledonia. Funding has come from Canada, New Zealand, Australia and the International Ocean Institute - Pacific Islands.

I wish to acknowledge the assistance of and major contribution by Tony Chamberlain, Lecturer of the USP Marine Studies Programme/Post Harvest Fisheries Project; Patricia Tuara, previous SPC Community Fisheries Adviser; Lyn Lambeth, SPC Community Fisheries Officer and other trainers in previous years.

I am grateful to the Marine Studies Programme technical staff who have given their time to training women and also the USP for facilities and equipment used during the course. I acknowledge Dr Jimmie Rodgers, Senior Deputy Director-General of SPC in Suva and the SPC Management for supporting CETC, by providing facilities and resources towards the implementation of the Fisheries course. We hope you enjoy this manual in the series.

Best wishes for a successful fisheries training programme.

Nu'ufou Petaia

Principal

SPC Community Education Training Centre (CETC), Narere, Fiji Islands

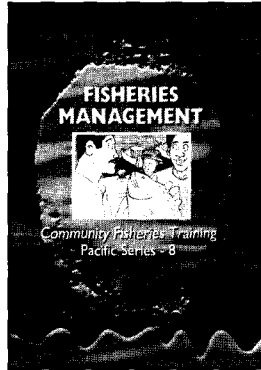
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Contents

How To Use This Book	v
Objectives	v
Chapter One – Threats to the Marine Environment	
<i>Loss of mangrove forests</i>	1
<i>Disappearing coral reefs</i>	5
<i>Marine pollution</i>	6
<i>Introduced species</i>	10
Chapter Two – Unsustainable Fishing Practices	
<i>Overfishing</i>	12
<i>Destructive fishing</i>	13
Chapter Three – Good Management	
<i>Introduction</i>	17
<i>Fish and invertebrate biology</i>	17
<i>Sustainable harvesting</i>	21
<i>The role of women in fisheries</i>	24
<i>Community-based fisheries management</i>	30
Words and Their Meaning	35
Related Resources	37

Fisheries Management:

Community Fisheries Training - Pacific Series 8



How to use this book

This manual is divided into three chapters: Chapter One looks at threats to the marine environment; Chapter Two examines how human fishing activities are leading to reductions in fish stocks; and Chapter Three looks at management practices that help overcome problems that threaten the future of fisheries and the marine environment. A series of Activities, Discussion and Demonstration suggestions are included in each chapter to encourage further exploration of the subject. The objectives listed below may serve as a guide for learning.

Objectives

After reading this book and completing the exercises you should be aware of:

1. major threats to the marine environment, (e.g. mangrove destruction, global warming, marine pollution and introduced species);
2. how human fishing activities can also lead to a reduction in fish stocks; and
3. ways to overcome these problems through better management practices.

Chapter One - Threats to the Marine Environment

Loss of mangrove forests

The importance of mangroves

Ecological, economic and cultural functions of mangrove products and mangrove ecosystems to local communities in the Pacific Islands.

Source: Adapted from Thaman and Clarke, 1993



Their future...

The Pacific Islands contain only a small percentage of the world's mangrove forests, with the largest areas found in PNG, Solomon Islands, Fiji Islands and New Caledonia. Mangrove forests decline in diversity from west to east. American Samoa is the eastern limit of mangrove growth in the Pacific Islands, although mangroves have been introduced to Hawaii and Tahiti.

Mangrove forests have traditionally been sources of construction wood, herbal medicine, food and dye. Recently, however mangrove forests have been reclaimed to provide settlements, agricultural land, infrastructure or dumps. In Tonga for instance, all significant mangrove areas are now allocated for clearance. It is clear that despite the traditional uses of mangrove forests in the Pacific, mangroves are not highly valued and remain a threatened resource.

ECOLOGICAL

- animal and plant habitat
- nursery area for young animals
- spawning ground
- feeding area
- food source
- shade
- erosion control
- wind, wave, tidal and sea level rise protection
- salt spray protection
- flood and runoff control
- nutrient cycling
- soil improvement
- water purification
- solid waste removal
- weed and disease control

ECONOMIC AND CULTURAL

fuel for cooking or heating	ornamental plants
fuel for steam engines	plant stakes
house construction	musical instruments
timber and	cooking oil
caulking for boats	source of marine animals
sails	staple foods (leaves and fruit)
roof thatching	snack foods (cakes, jellies)
charcoal production	sugar
wood chips	alcoholic drinks
matches	non-alcoholic drinks
cigarette wrappers	vinegar
weapons and tools	spices and flavourings
sandpaper	meat tenderiser
torches	honey production
containers	preservatives
handicrafts	incense
fishing equipment	perfumes
corks and floats	deodorants
children's toys	sunscreen
brooms	insect repellents
paper	human medicines
fibre and fabric	fertility control
mats	aphrodisiacs
baskets	health tonics
hats	embalming corpses
beads	poisons
toothbrushes	animal medicines
paint brushes	food for domestic animals
toilet paper	animal cages or pens
rope and twine	recreation and ecotourism
glue	magic and religious totems
dyes	subjects of mythology
tannin for leather curing	sacred sites
medicine	private meeting places

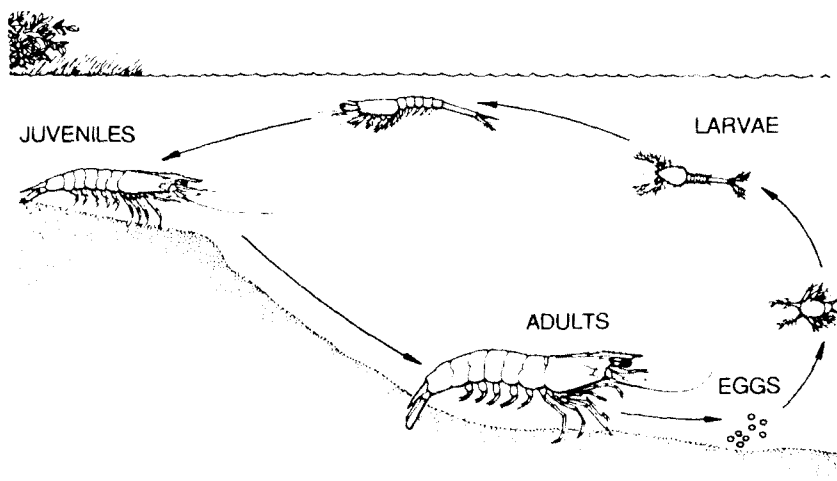
Mangrove forests are as important as coral reefs and seagrass beds in providing habitat for marine and terrestrial organisms. Mangroves are breeding grounds and nurseries for many marine animals including rabbitfish, prawns, Spanish mackerel, crabs, emperor fish, lobsters and turtles.

Information Box

The biology of prawns

Most commercially important prawns in tropical areas belong to a group known as penaeids. The adults of most commercially important penaeid prawns live and spawn in deeper water away from the shore.

Penaeid prawns have separate sexes and the female, which is larger than the male, produces several thousand eggs. After mating, the fertilised eggs are released directly into the sea, whereas other crustaceans carry their eggs beneath the abdomen. The eggs hatch and grow through several larval stages as they move inshore into mangrove creeks and estuaries, which act as nursery areas for the juveniles. Because of their requirement for brackish water, prawns are usually found only in mountainous islands which have sufficient rainfall to produce rivers and estuaries.



The life-cycle of a penaeid prawn. Fertilised eggs are released in deeper waters where they hatch and progress through several planktonic larval forms. The larvae reach inshore nursery areas, often mangrove creeks, where they live and grow before migrating out to join the adults.

Mangrove forests protect coastal areas from erosion, maintain and build soil, and protect against cyclones. They are adapted to withstand continuous wave action, periodic drying due to tidal changes, and the influence of saltwater and salt spray. By assisting in the settling of sediments and filtering water, mangrove forests protect reefs from sedimentation and pollution.

Threats to mangrove forests

The limited mangrove forests in the Pacific Islands are vulnerable to over use. For example, mangrove forests in urban areas are susceptible to the effects of urbanisation and development activities. Threats to mangroves include: expansion of squatter settlements, overexploitation of mangrove products, reclamation of land for commercial, industrial and residential use, drainage outlets and estuarine dredging for flood control.

It is estimated that more than 80 per cent of Suva Peninsula's mangroves have been reclaimed for urban development, with a further 6 per cent converted to other uses. Other threats affecting mangrove areas include: increasing populations living near the coast, commercialisation of mangrove products, pollution, and lack of enforcement of regulations protecting mangroves.

Mangroves are destroyed by:

- humans cutting them for firewood, construction materials, dyes, and other uses;
- land reclamation and coastal development; and
- pollution.

This destruction occurs because of:

- population pressures;
- economic rewards;
- lack of alternatives;
- poverty; and
- lack of regulations (especially regulations covering subsistence use) and enforcement.

Protecting mangrove forests

Mangrove forests need to be protected to ensure they continue playing an important role in coastal ecosystems, while still providing many sustainable products and functions for coastal communities. Communities should be aware of the importance and usefulness of mangrove forests, and efforts must be taken to ensure that mangroves are protected for the future.

In some parts of the Pacific, communities and governments are undertaking measures to ensure the protection and survival of mangrove forests. Occasionally, mangrove management plans have been formulated, but many are yet to be implemented.

In some countries, governments, non-governmental organisations (NGOs) and community groups are involved in rehabilitative work. Mangrove forests are being replanted and protected to allow these areas to recover from overuse or destruction.



4 - 6 year old mangroves in Naboutini.



Women in Namena, Tailevu, Fiji Islands, work at replanting mangroves, a step towards setting up a marine reserve in their qoliqoli, or fishing area



Natural mangrove next to replanted mangrove.

In addition, participatory mangrove monitoring is being promoted to support mangrove conservation and sustainable management.

Mangrove monitoring can provide baseline information for:

- developing comprehensive management plans;
- implementing mangrove regulatory programmes;
- documenting mangrove degradation;
- developing water quality standards; and
- identifying mangrove rehabilitation sites and guidelines.

To achieve mangrove conservation and sustainable management, all Pacific Island communities, as well as their governments and donors, need to work together. Mangrove forests, like coral reefs, are living resources that need to be protected and used wisely to ensure their continued existence and usefulness.

Activity

Divide into groups and discuss the following questions:

1. Where have mangroves been destroyed in your country?
2. Why were they destroyed?
3. Do you know of any protective measures for mangroves that are in use in your country?



Collaboration in the rehabilitation of mangroves.

Information Box

In Verata and Votua, Ba, the people have declared Mangrove Forests as part of the Locally Managed Marine Areas. These communities are mindful of the importance of mangrove resources and want to protect them. In Malawai, Gua people banned the use of mangrove aerial roots for garland when they were told of the negative impacts on a very useful resource. The people are actually replanting mangroves to help overcome their coastal erosion problems. Mangrove replanting is undertaken in Viti Levu. The Forestry Department collaborated with OSICA - a Japanese NGO - to involve coastal communities in Viti Levu to replant mangrove forests. This is now undertaken in Saiko in Ra, Korotoga in Nadroga and Naboutini and Vunaniu in Serua.

Disappearing coral reefs

In losing its corals, the world is losing more than just colour. Life-saving medicines, tourism, a protective barrier around coastlines, and an incredible diversity of life are all under threat as coral reefs are destroyed around the world. Coral reefs are threatened by pollution, sedimentation arising from deforestation, unsustainable harvesting, bleaching and destructive fishing practices. Global warming, climate change and sea level rise also damage coral reefs. A rise in seawater temperature in the Indian Ocean by just one degree over a period of several weeks in 1998 destroyed, in some areas, 80 to 90 per cent of

the corals. Whole reefs died, some more than 1000 years old, around the Maldives and Seychelles.

Unusually high sea temperatures can kill reefs by causing coral bleaching. Most corals are small animals (polyps) that live in groups, or colonies, and form reefs. Hard corals create a skeleton of limestone (calcium carbonate), which slowly builds upwards to form a reef. A single coral polyp has a tube-shaped body with a mouth surrounded by tentacles. Polyps feed in two ways: by using tentacles to catch passing plankton; and through a partnership with tiny algae, or plants, that live in the coral tissue. It is the algae that give the coral its colour. These algae are called zooxanthellae and, like other plants, they use sunlight, water and carbon dioxide to produce nutrients. Some of the nutrients are used by the coral and in exchange, the coral provides the zooxanthellae with shelter and other nutrients. When the environment is disturbed (for example, by water pollution, rising sea temperatures, or considerable changes in salinity), the algae are lost and the coral changes colour. If the disturbance or stress lasts too long, the coral dies, leaving behind only its white skeleton. This is referred to as coral bleaching.

Coral reefs provide a haven for a huge variety of life forms, so the loss of life caused by the Indian Ocean sea temperature rise was staggering. Coral reefs are fragile environments and the world's remaining reefs are in danger of disappearing forever. An estimated 70 per cent of the world's 600,000 square kilometres of reefs are thought to be in danger of disappearing in the next 40 years. Southeast Asia has the most species-rich reefs on earth, but they are also the most threatened. More than 80 per cent are at risk, mostly from coastal development and fishing pressure, including destructive activities such as fishing with explosives.

Activity

Divide into groups and discuss the following questions.

1. Do you know of areas where coral bleaching has occurred?
2. What caused this to happen?

Marine pollution

Pollution is anything that makes the environment unclean, especially harmful or poisonous substances, or substances that are not biodegradable. Marine animals and plants need clean seawater to live, and are very vulnerable to the effects of pollution caused by rubbish dumping, sewage, fertilisers, oil, detergents, pesticides and even sediments from land clearing.



Rubbish on Pacific Island foreshore.

What happens to the garbage and oil you dump overboard?

Sea turtles often mistake plastic bags and balloons for one of their favourite foods — jellyfish. When they do, they die a slow and painful death because their gut becomes blocked.

Marine animals such as whales, sharks and dolphins see garbage such as bait box straps and six-pack packaging rings as an item of curiosity and become tangled up or strangled to death as a result of "playing" with them.



Seabirds eat small plastic pellets and bits of styrofoam mistaking them for food such as small fish or squid, which can then cause the birds to die.

Fish, turtles, and other marine animals can get entangled in derelict fishing gear such as gill nets; this gear can continue to catch fish many years after being lost or discarded.



Marine animals that encounter nets and other fishing gear may drown, lose their ability to catch food, and be more susceptible to disease and predators.

Seabirds that get covered in oil often die because when they try to clean themselves they ingest some of the oil, which poisons their liver, kidneys, and intestinal tracts. The oil also destroys the insulating and waterproofing properties of their feathers.

Oil can destroy seagrass beds, mangroves, corals, crustaceans (crabs and lobsters), molluscs (giant clams and trochus), and other reef organisms by smothering them and cutting off light and oxygen necessary for their survival.

How much garbage is out there?

While no one knows for certain, one figure indicates that more than 450,000 plastic containers were dumped in the ocean every day by the world's fleet of merchant vessels during the late 1980s. Walk along any Pacific Island beach and you will see hundreds of plastic items and other debris, providing unsightly evidence of what has become a major problem.



Keep Our Ocean Clean



Many coastal areas around the world, especially in nations with heavy industry and large populations are polluted. The Pacific Islands contain some of the least polluted waters in the world, although lagoons close to towns are becoming more polluted every year. Marine pollution in the Pacific is increasing as more and more people demand living space, create more sewage, and dump more rubbish. Increasing numbers of people mean more cars, shops, factories and more pollution.

Activity

1. Describe some marine pollution problems in your local community.
2. Discuss ways that you can help to raise public awareness of marine pollution and litter.

Beach litter and waste disposal

Most capital towns in the Pacific Islands have a problem disposing of waste, many streets and coastal areas are littered with rubbish. Even where rubbish bins are provided, some people do not use them. Beer and soda cans and bottles are a particular problem because of the large quantities that are tossed out, and the long-lasting materials the containers are made from (glass and plastic especially). In most Pacific Island towns, rubbish dumps are located in mangrove swamps or low-lying areas. Rotting food and chemicals washed from the dump may create health problems. People should be careful of eating seafood caught from these areas.

In the past, all rubbish was biodegradable and there were few poisonous substances dumped into the environment. There was no concern about dropping a coconut frond plate in the water or throwing away a coconut shell after drinking. Now, however, modern packaging, imported goods and dangerous chemicals makes such behaviour irresponsible. Many people still see nothing wrong with dumping their rubbish into the sea or on beaches.

The problems are more serious on small islands and atolls where there are few places to adequately and safely store rubbish. To compound matters, a considerable amount of rubbish comes from distant places when ships at sea throw their rubbish overboard. Despite this being illegal, ships still continue to dump many types of rubbish into the sea. Plastic bottles and containers can float thousands of kilometres across the ocean.

Most beach litter, especially plastic, takes a long time to break down and may be lying around on our beaches and reefs for many hundreds of years. If rubbish dumping continues at the same rate, or increases, there will eventually be more rubbish than beach. Not

only does this litter stay in the environment for a very long time, it can also:

- kill fish, turtles, dugongs, corals and other marine species (e.g. plastics can suffocate and strangle fish that swallow it or get tangled in it, old fishing nets can entangle fish (ghost fishing), and corals can be smothered or broken by rubbish);
- spoil the appearance of coastal areas for both tourists and local people;
- block cooling water intakes and damage boat engines; and
- foul propellers and endanger human life by causing breakdowns at sea.

Activity - survey of beach litter

This beach survey will require you to bring a notebook, measuring tape and large bags in which to collect rubbish.

1. Divide into groups of three. Each group should measure out a 50-metre length of beach (you can cover any width).
2. Remove all litter within your 50-metre section of beach and place it in a pile.
3. a) note the composition of each piece of litter, e.g. plastic, paper, steel can, aluminium can, etc.
b) discuss the possible use of each piece of litter, e.g. beer can, glass beer bottle, plastic bottle, milk carton, drinking straw etc.
c) speculate on where it might have come from, e.g. local restaurant, picnickers, fishermen, foreign vessels etc.
4. Carefully record the number of items in each group, and what they are made of.
5. Calculate the percentage of each item. For example, the number of beer cans divided by the total number of items times 100.
6. Discuss the results of your beach litter survey. Where do you think most of the litter came from? Suggest better ways of disposing of litter.
7. Suggest ways you could tell people about the correct way of disposing of litter.
8. When you have finished at the beach, do not forget to take the litter to the local dump.
9. Design a project to encourage people in your town or village to correctly dispose rubbish.

How long does it take to break down?

Many items of marine debris, especially plastics, take a long time to break down and may be lying around our beaches and reefs for many hundreds of years.



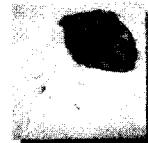
Here are some specific examples:

Band/hairnet line/netting	100 years
Polystyrene cups and pellets (used in packing material)	500 years
Plastic six pack packaging rings	500 years
Aluminium cans	80-100 years
Tin cans	50-100 years
Orange peel	6 months

Keep Our Ocean Clean 

Plastic

Plastic is the worst kind of garbage. Its light weight means it can be carried hundreds and even thousands of miles by ocean currents and winds. Plastic is used for all sorts of purposes on boats, including containers and fishing gear. Such items all have one thing in common: they're not biodegradable. That means nature has a hard time breaking them down.



Oil and oily waste

Inboard engines tend to leak oil into bilges over time, either because of small leaks from hoses or the engine itself, or because sump oil is drained directly into the bilge. When oil from engines and hydraulic systems accumulates in the bilge and is then pumped out — whether at sea or dockside — it causes damage to reefs and other marine life. Don't use detergent to break down the oil as it only causes it to sink when the bilge is pumped, and will harm marine life on the seabed.



Ships running aground provide the biggest potential risk of marine pollution, when massive quantities of oil, diesel, and other contaminants are released directly into the ocean. Most Pacific Island countries do not have adequate equipment or training to cope with an oil spill.

The garbage you throw overboard may ruin your boat or cost someone else their life.

- Item such as rope, fishing line, and plastic bags can easily get tangled around the boat propellers and block cooling water intakes, causing major damage and expensive repairs to vessels. With no working engine a boat and its passengers may drift about in the sea with no hope of rescue.

What's the law?

A number of Pacific Islands have signed an international agreement (the International Convention for the Prevention of Pollution from Ships — MARPOL 73/78). This Convention lays down three basic rules:

- Do not discharge oil or oily mixtures into the sea.
- Do not throw plastic products into the sea.
- Do not throw garbage overboard within 12 nautical miles of the nearest land or reef.

As responsible members of the international community, Pacific Island countries support these international laws and some are now implementing national legislation based on these pollution regulations. The Secretariat of the Pacific Community and the South Pacific Regional Environment Programme are assisting countries in putting these laws in place.



Graphic source: "Think Don't Throw" Leaflet, Fisheries Development Section, SPC

Activity - recycling waste on the island

- List items from your community that are recycled.
- Are any bottles recycled? How are they re-used?
- Where are the collecting booths located? Are they accessible?
- Suggest ways to make your community more aware of the benefits of recycling.
- Suggest how a business could be developed through recycling any of the items you listed above.

Nutrients

Soil erosion, fertilisers and sewage increase the levels of nitrogen and phosphorous (nutrients) in the sea. More nutrients in the sea can cause some types of seaweed and phytoplankton to grow or bloom. Some of these may be dangerous and can kill other plants and animals or cause sickness in people eating seafood from affected areas. Some seaweed may grow over corals and kill them, especially if the reef is already stressed by pollution or other problems.

High nutrients are found in lagoons close to urban areas because of seepage from septic tanks during heavy rainfall

Activity - marine environment checklist

Visit as many nearby aquatic environments as you can.

Place a tick or cross beside the question:

- Is the water frequently cloudy?
- Is much of the bottom covered with silt?
- Is there widespread algal growth?
- Are there yellowish substances coming out from the industries to the creek?
- Are there reports of massive fish kills in your area?
- Is there rubbish on your beaches?

Chemicals and heavy metals

The sea, especially coastal waters, have long been seen as a dumping ground for people's wastes. Wastes from industries, mines, towns, and farms or from ships may contain chemicals and heavy metals that poison marine life. Chemicals that are dangerous to marine life include:

- heavy metals such as mercury, lead cadmium and copper. These come from mines, shipyards and batteries;
- poisons from antifouling paints;
- pesticides, insecticides and weed killers from farms and towns;
- oil from ships and towns;
- diesel and petrol; and
- detergents from kitchen sinks.

There isn't much heavy industry in the Pacific Islands, but heavy metals come from mines and discarded batteries. Shipyards often have poisonous runoff from toxic paints and solvents, while shipwrecks can cause large quantities of oil and other contaminants to be released into the sea. Oil is also released when ships and boats pump their bilges, or perform oil and filter changes, often while in harbour. Leaking hoses when refuelling also cause pollution.

Introduced species

New species of fish, invertebrates or sea plants are sometimes deliberately introduced into the environment to increase food and generate money and jobs. Sometimes, however, species are introduced by accident. Marine species may be introduced by:

- ships (e.g. organisms in ballast water or on hulls);
- trade in aquarium fish;
- aquaculture; and
- fisheries (e.g. commercial, recreational, stock enhancement, organisms carried on fishing equipment, live bait fish).

No matter how the new species was introduced, the effects on the local ecology are usually irreversible; or at the least, there is a high degree of uncertainty as to the impact. Introductions can change the distribution and abundance of fishery resources through:

- disease;
- changes in predator–prey relationships;
- changes in competition;
- threats to genetic diversity; and
- habitat modification.

Sometimes a fisheries department or business person may try to introduce a new method of fish farming or aquaculture. Animals and plants often escape from the confines of their facilities and this can have serious impacts on local-capture fisheries.

The impacts of a new species on the local habitat and native species can last a long time, and it is extremely difficult to get rid of an introduced species once it has taken hold. The balance between the marine environment and native species may never be regained.

It is, therefore, important that research on the impact of introducing new species is done properly before even considering the introduction. The introduced species should also spend time in quarantine so that a qualified person can check for diseases before releasing the species into the environment.

Around the world, thousands of ships, some of them with ballast tanks that can hold millions of liters of seawater, routinely pump water in at one port, and out at another. Ballast water from ships can introduce foreign organisms into the ecosystem when the ballast water is discharged into the harbour. Red tides in New Zealand are thought to be caused by toxic dinoflagellates from Japan, carried in the ballast water of ore carrier ships. These red tides have killed inshore marine resources and contaminated shellfish, causing the closure of many oyster farms. Even more common than the introduction of marine organisms in ballast water is their transport on the hulls of ships.

Chapter Two – Unsustainable Fishing Practices

Overfishing

A fishery or fish stock refers to a population of fish of the same type, or species, living in one area. Fisheries management attempts to maintain that population of fish over long periods, while harvesting a sustainable amount. This means we need to be cautious about how much we harvest, what fishing gear and methods we use, and how we maintain the habitat the fish stock needs to survive.

In the Pacific Islands, many inshore fisheries resources have been overexploited, including giant clams, trochus, sea cucumbers and some popular fish species such as Napoleon wrasse.

These resources were not used sustainably; in other words, the rate of harvesting was far greater than the resources' ability to replenish and regenerate. The use of efficient gear and the increasing numbers of people fishing have made the problem worse. Sea cucumbers have been depleted in the past, but the current rate has been particularly rapid because of the use of hookah diving equipment. Underlying causes of overfishing are:

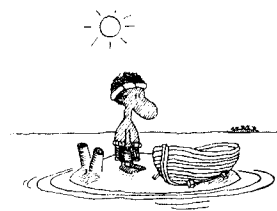
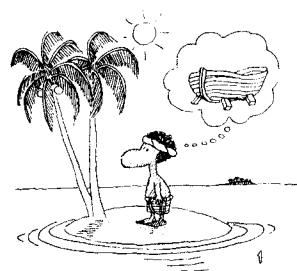
- increased subsistence fishing (due to economic downturns, and increasing populations);
- increased commercialisation (e.g. demand from tourism industry, increase in commercial fishing);
- increased use of destructive and unsustainable fishing practices (e.g. dynamite, small mesh gill nets);
- weakening of traditional management measures; and
- lack of alternative sources of income.

The seriousness of the problem is evident in the declining catches of marine resources, especially in inshore lagoons and reefs.

Sustainability of development projects based on inshore resources

Fisheries development is promoted to generate income and increase the availability of seafood for local and export markets. Often, there are few management measures in place - increasing numbers of people enter the fishery, methods and gear are unrestricted, and the resource is overharvested, leading to declining catches.

Fisheries resources that provide the basis of fisheries development projects are often rapidly depleted. An example in the Pacific is the beche-de-mer fishery. In many areas, the high value species of sea



Information Box

Sea turtles

Sea turtles are a threatened species because of the combined effects of overfishing and habitat loss. Turtles have long been hunted for a variety of uses. Their shells have been used to make jewellery and ornaments, their skin to make small leather goods, their meat and eggs for food, and their fat for oil. In modern times, the number of sea turtles taken has increased dramatically because of the opportunity for profits through commercial trade. In addition, turtles continue to be hunted for subsistence use. The following message is from a public awareness project in the Maldivian Islands in the Indian Ocean:

Please HELP to save them

Help to save the marine turtle! Please do not buy jewellery and gifts made out of turtle shell. Stop turtle slaughter for your happiness. Do not purchase or use any items made out of turtle shell. Populations of all species of turtles are dwindling due to a number of reasons, and it is feared that this ancient creature will be totally wiped out from the Maldives in a relatively short period of time. Many governments are trying their best to protect the turtles that inhabit the territorial waters. Presently the bulk of the turtle killing is attributed to the tourist industry as there is a high demand for items made of turtle shell. Tourists can assist us immensely in stopping the market. We urge you not to purchase any items made out of turtle shell be it jewellery, ornaments or souvenirs of any sort. The Maldives, like many countries, has banned the export of turtle shells and products made from turtle shell. In the Pacific, as elsewhere in the world, the trade in turtle parts or products is illegal under an international agreement. Unfortunately, the trade in sea turtles and sea turtle products continues at an alarming rate.

cucumbers have been depleted in a very short time, and the fishery has collapsed.

Once catches of the resource start declining and the signs of depletion are evident, management measures must quickly be introduced and development halted. Planned development projects, therefore, must be carefully examined to ensure they will be sustainable.

Activity

1. Work in groups to discuss and list at least three fisheries development projects that have been undertaken in your country.
2. Explain the reasons for the project
3. Were the projects successful?

Destructive fishing

Destructive fishing practices include methods that kill or smash corals and rocks, or that kill many plants or animals, not just the ones you are fishing for. Examples include the deliberate breaking of corals to catch sheltering fish, and fishing with dynamite or poisons (cyanide, bleach or traditional plants). Even walking over delicate corals can be destructive. Fish drives and some collecting activities may involve damage to corals, either from people walking over the reef, or as a result of overturning or breaking coral to catch sheltering fish. Always take care when fishing to avoid breaking corals, which provide shelter for fish and shellfish. Replace rocks the way you found them when searching for seafood. This will ensure the marine organisms on the undersides of the rocks will survive to provide food for other animals, and that the rocks will continue to provide a home for the animals you collect.

Destructive fishing methods damage the coral reef environment, which many marine organisms depend on for survival and reproduction. In shallow lagoons and coral reef areas, damage from destructive fishing practices can be severe. Explosives and poisons such as bleach are many times more damaging to small animals, such as fish larvae and coral polyps, than they are to large fish. Destroyed coral reefs result in low fish populations, and may not recover for more than 20 years.

Source: "Please Help Save Them": Protection of the Marine Turtle. An Awareness project by Mohammed Zahir, Environmental Journalist, Havelu Daily, Male, Republic of Maldives.

FINAL WORDS! WE WHO HAVE EARS - LISTEN - IT'S A MATTER OF LIFE!

MORAL of the STORY



TODAY BECAUSE THERE ARE MORE
PEOPLE IN OUR VILLAGE

WE ARE CATCHING
MORE AND MORE FISH TO EAT

WE ALSO
KILL THROUGH POISON
AND EXPLOSIVES
LIKE DYNAMITE

THE CORALS WHERE SEA ANIMALS LIVE
ARE ALSO DESTROYED.

WE WASTE
SEAFOOD
BY TAKING
MORE THAN
WE NEED

WE KILL
BABY
FISHES

PLEASE
GET A DOCTOR
POISON
YUK!!

FOOD FOR LATER

WHICH COULD PROVIDE
BIGGER

WE
MUST
NOW

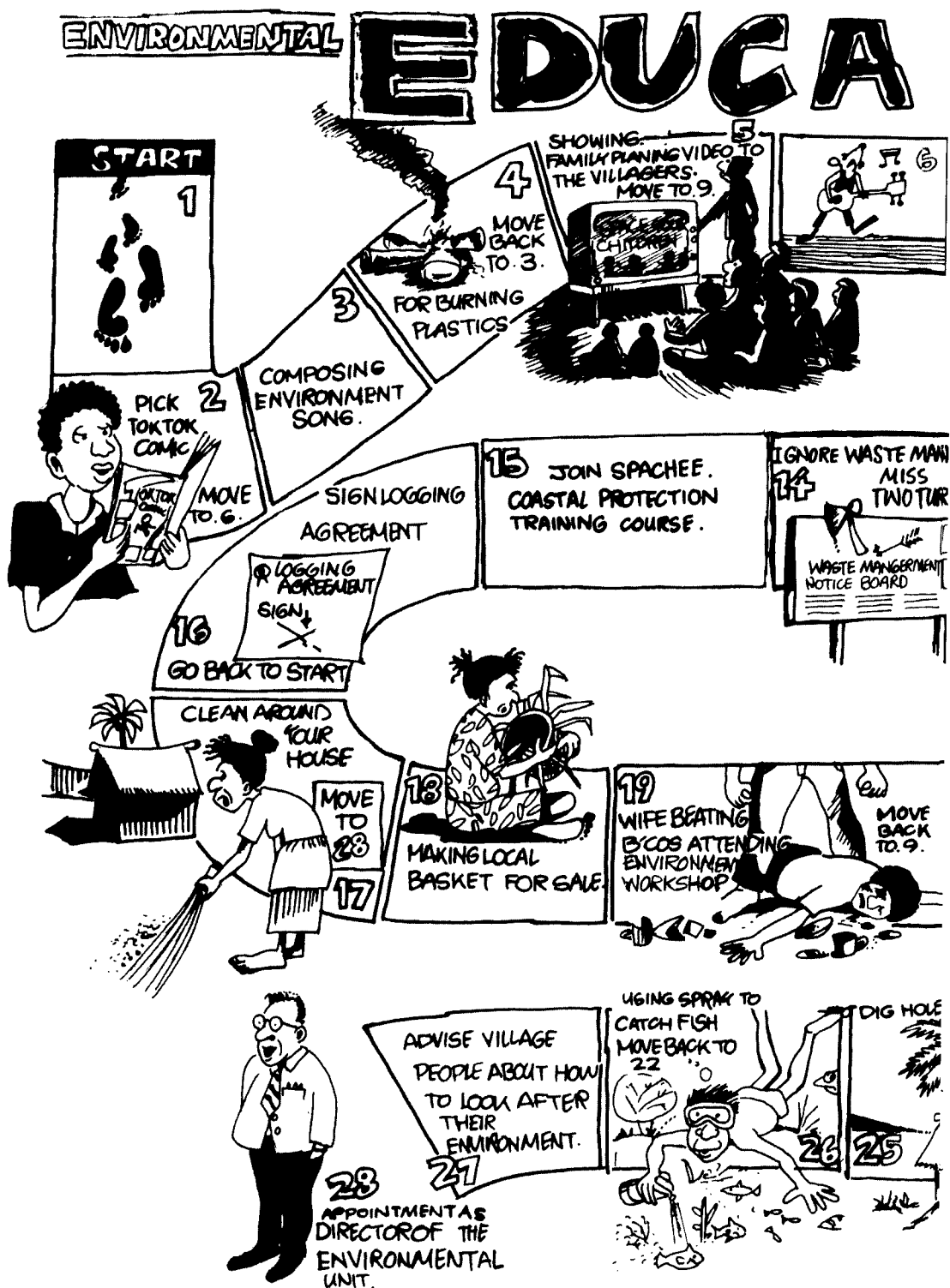
- CATCH FISH IN WAYS THAT WE CAN
ONLY TAKE WHAT WE CAN EAT.
- WE CAN USE
FISHING
LINE & HOOK

SPEAR GUN
FISHING NET
BUT ONLY BIG ONES
THAT CAN LET
SMALL ONES SWIM
THROUGH WITHOUT GETTING CAUGHT

ALSO NAME AREAS
WHERE FISHING IS
NOT ALLOWED AT
CERTAIN TIME SO
NO FISHING THAT FISH
CAN HAVE TIME
TO BREED

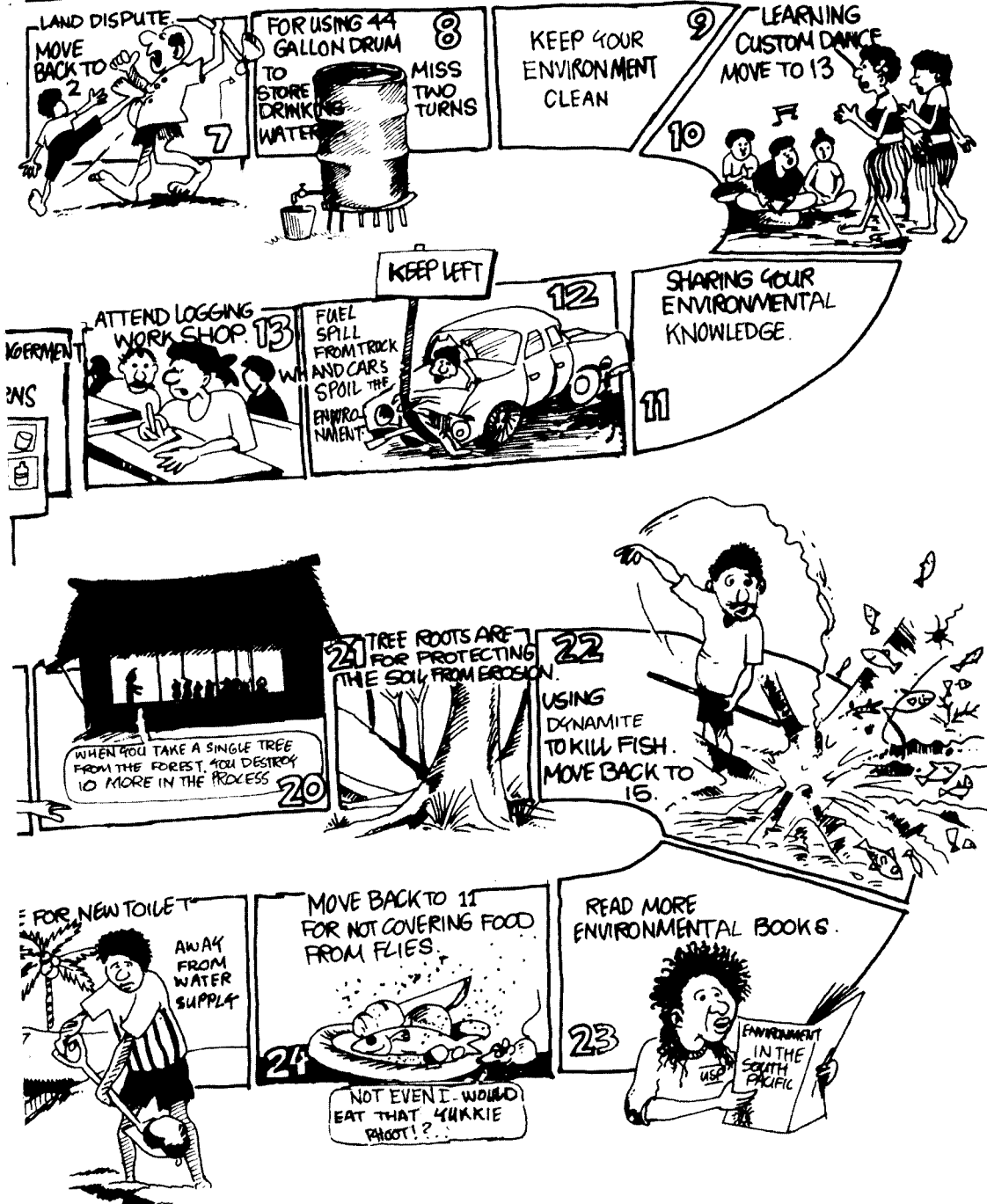
IF WE DO THESE
THINGS WE WILL
HAVE ALL
FISH
ALWAYS





CTION GAME

DRAWING 84,
NELEON HORIPUA. 4/7/95.



Chapter Three – Good Management

Introduction

Fisheries management and conservation are about protecting marine resources and habitats. Simply put, it is what we need to do to make sure we have enough fish, shellfish and other seafood for our children and children's children.

Coastal waters are where most of the fisheries resources we harvest live, and it is one of the areas most in need of good management.

Coastal waters:

- occupy 18 per cent of the earth's surface;
- are where around 25 per cent of global primary productivity occurs;
- are where around 60 per cent of the human population lives;
- are where between 60 and 70 per cent of the world's cities with populations of over 1.6 million people are located; and
- supply approximately 90 per cent of the world's fish catch.

Marine resources such as fish, shellfish, crabs and sea cucumbers can continually be caught and eaten as long as the numbers caught are replaced by enough young. To make sure this happens we must manage the resources to ensure that too many aren't caught. We must also protect the marine environment to ensure the resources have a healthy environment to live in. By doing this, there will be enough living to breed and produce enough young to replace those that are eaten by other species, or caught by people.

Fish and Invertebrate Biology

To understand the need for fisheries management, marine environmental protection, and controls or regulations on fisheries activities, it helps to understand something about the biology and reproductive characteristics of fish, shellfish and other marine life. In this section we will look at fish and invertebrates, and what they need to live and reproduce. An invertebrate is an animal without a backbone such as a clam, crab, lobster, sea cucumber or sea urchin.

Reproduction

Fish and invertebrates are like humans in that they have to reach a certain age and size before they are physically mature enough to start breeding. The size and age differs for different animals, even for quite similar species. For example, scientists have studied some

What is a Fishery?

A fishery includes a complex set of interactions between the environment, the fish and the people involved in fishing and handling the catch. To properly manage a fishery it is important to understand the five sectors involved and the way they interact.

I. The marine environment

The marine environment consists of the living and non-living surroundings of a marine species - thus, both corals and seawater are parts of the environment of a reef fish. Protection of the many different types of Pacific Island marine environments is essential for ensuring the well-being of fish and invertebrates.

commercially important sea cucumbers and estimated the size each species needs to reach before it can begin to reproduce. This is called size at first maturity. These estimates are what many size regulations, discussed in the next chapter, are based on. On average, sandfish (*Holothuria scabra*) must reach 16.5cm in length before they are able to reproduce, while the black teatfish (*Holothuria nobilis*) must reach 26cm. A 15cm sandfish or a 20cm black teatfish is still immature and will not have had a chance to reproduce. Unfortunately, there are many species that have not yet been studied, especially non-commercial invertebrates.

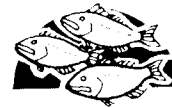
Many fish and invertebrates produce hundreds, or even millions, of eggs each time they breed. Therefore, allowing them to breed even once before they are caught will potentially result in hundreds or millions of young. Not all these young will survive long enough to breed themselves, but it is still important to allow each species to reach its size at first maturity.

Once the animal has reached maturity, it is ready to spawn, often at a particular time of the year or moon phase when all the other breeding individuals of that species are also ready. Many fish and invertebrates reproduce in a similar way - at spawning time the animals release eggs and sperm, often numbering in the hundreds or millions, directly into the water where they mix. If the mixing is successful the eggs become fertilised and develop into larvae, a tiny, swimming form of the animal. The larvae then drift with the tide and currents for differing lengths of time, depending on the species. Some species may drift for days or even weeks, often going through larval changes before reaching the juvenile form of the adult. In the case of many invertebrates the larvae go through several stages before settling on the bottom and developing into adults.

Because most invertebrates do not move very far or fast, there needs to always be a number of mature individuals of both sexes close together in order for reproduction to be successful. If the individuals are too far apart, eggs and sperm are unlikely to meet, and fertilisation will not occur. Invertebrates can especially benefit from protected areas, or from selective harvesting that leaves groups of mature individuals undisturbed and close to each other.

Once a female fish or invertebrate has reached breeding age the number of eggs it produces is related to its size: larger individuals produce many more eggs than smaller ones. For some fish, if a female is allowed to double in size, the number of eggs she produces will increase eight times.

2. A fish stock



A group of fish of the same type or species living in one area is called a fish stock. In a fishery, a fish stock or fisheries resource is a population of fish, or other marine animal, which is harvested. There are many different types, or species, which are fished in the Pacific.

3. A fishing operation



A fishing operation can be a simple one, such as the collection of trochus on a reef, or it may be a much more complicated one, such as the catching of tuna by a large fishing vessel.

4. Processing



Processing ranges from a basic treatment of the catch, such as the storage of fish on ice, to the technologically more sophisticated procedure of canning.

5. Marketing



Marketing can refer simply to the sale of fish from a local market but, in the case of exported seafood, involves securing overseas sales and transporting the catch to foreign countries.

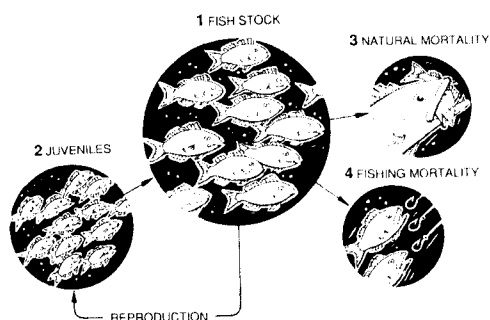
Life cycles and habitat

Many marine species spend different parts of their life cycle in different areas. For example, some juvenile species of fish grow up in sheltered inshore areas, such as mangroves, before they move offshore to where the adults live. Other species, such as some reef fish, shellfish, crabs and lobster, produce young that float out to sea as larvae, before growing and returning to the reef as young adults, or settling on the bottom to grow (e.g. shellfish). When we consider the environment or habitat the animal depends on, we need to also consider all the places it lives during its life. Think about a fish that lives in the ocean but spends part of its young life growing in sheltered inshore areas. Anything that affects the health of the inshore areas will eventually affect the health of the adult population of that species of fish.

Factors influencing the size of a fish stock

Most fishers know that the numbers of fish in any particular area are always changing. Sometimes there are few fish, and at other times there are many. A fish stock, and the factors that control its numbers is shown below.

If a fish stock is not exploited or is fished at a low level, losses due to mortality are balanced, on average, by gains through the birth of new fish (recruitment of young fish or juveniles) to the adult stock. The number of fish in the stock will therefore fluctuate around the average level as long as too many fish are not caught. It is for this reason that fish are referred to as a 'renewable resource'. That is, fish can continue to be caught and eaten for many generations, as long as the numbers caught are replaced by more young fish.



A fish stock is a simple biological system. The fish stock (circle 1) is increased by reproduction, which results in the recruitment of young fish (circle 2) back into the stock. At the same time, the stock is reduced by natural mortality (circle 3) and, in exploited species, by fishing mortality (circle 4) as well.

If exploitation is high, however, the numbers of adult fish may be reduced to a level where reproduction is unable to keep pace and replace the numbers lost. That is, if the numbers caught (circle 4) become too large, recruitment (circle 2) will be too small to maintain the stock size (circle 1). In this case the numbers of fish in the stock will decrease. In severe cases of overfishing, the stock may even become extinct.

In Pacific Island nations, increases in human population sizes and the number of commercial fishers are causing many fish stocks to be overfished. Some species of giant clams are now extinct in Micronesia, possibly because they are popular and easily caught, and one species of clam disappeared from Vanuatu and Fiji Islands in the 1970s. Stocks of mullet, which can be caught in large numbers in fence traps, appear to be decreasing on some islands. The renewability of fisheries resources depends on our ability to ensure that not too many fish and invertebrates are caught.

This implies that fisheries, and particularly the amount of fishing, must be controlled or managed.

In most places, a fish stock is a common property resource – that is, fish belong to everyone in the community. If a villager who owns a number of pigs manages his stock carefully, he will reap the benefits of this sensible management. A fisher, however, does not own the fish in the sea. If a fisher decides not to catch small fish, for example, in the hope that they grow to a more marketable size, other fishers may catch them before he or she does. In other words, a sensible management measure taken by an individual fisher may not result in any personal benefit. It is therefore necessary that the fishery be suitably managed.

Ideally the community should manage the fishery. However it often useful to also have an independent authority such as a Fisheries Department, or a local governing structure with the power to influence behaviour in the community if necessary and to carry out scientific research.

Although fisheries departments undertake many tasks, including the development of new fisheries and training fishers, a major task is to try and prevent the overexploitation of fish stocks. In commercial fisheries, there may be additional concerns such as the welfare and safety of fishers and economic efficiency.

Overexploitation, from a biological point of view, is where fish numbers are reduced to such an extent that the remaining adults are unable to produce enough young fish to replace the numbers lost. To try to prevent overexploitation, governments devise regulations or laws to protect fish stocks and prevent too many fish from being caught.

Activity

Fisheries management can take the form of formal, traditional or individual controls. Examples of each include:

Formal – a government law banning the use of certain mesh sizes of fish nets.

Traditional – a village rule banning the capture of certain fish at different times of the year.

Individual – a personal choice to not harvest undersized fish or shellfish.

Discuss some of the controls that you are familiar with (formal, traditional, individual) that govern your fishing practices, or are practised by fishers in your community.

Regulations may also be placed on fishing gear to protect small individuals. Minimum mesh sizes for nets, and escape gaps in traps, are imposed in many fisheries to allow small individuals to escape and grow to maturity.

Closed seasons and areas



Closed seasons restrict harvesting at a particular time of the year, while closed areas prevent harvesting in particular areas, either temporarily or permanently. Closed seasons and areas are often designed to protect species at vulnerable stages of their life cycle, such as spawning adults or migrating juveniles. Turtles, for example, are protected in some countries during the egg-laying months of November to February. Closed seasons can also be used to prevent stocks from being overfished by restricting fishing effort to a short season. In Palau, for example, fishers are allowed to catch trochus during only one month of the year.

The closure of particular areas can be used to protect juveniles and spawning stock. Shallow water mangrove habitats are known to be nursery areas for many species, and may be closed to commercial fishing. In some countries, known breeding areas for trochus are permanently closed to fishing.

In Samoa, many villages have set up their own closed areas, banning fishing or collecting from a small part of their inshore lagoon. These marine reserves are designed to provide an undisturbed environment for fish, invertebrates, corals and plants to grow and breed. As fish and invertebrate larvae drift with the currents, areas outside the reserve will eventually benefit from the protected area.

Setting Up a Marine Reserve

The sea provides islanders with most of their basic needs including food, a source of income, transportation and medicine. Furthermore, legends, folk stories, myths, cultural beliefs and practices are related to the sea. For example in the Fiji Islands, a god of the sea is called Dakuwaqa. In relation to culture and tradition, it is evident that certain practices are common among Pacific communities such as restrictions or taboos placed in certain fishing areas to observe the death of a chief. As well, certain marine resources such as turtles are reserved for chiefs.

These are some of the many practices that have been observed historically. While some practices still exist today, most have been lost or disregarded in order to survive in an increasingly modernised system with the emphasis on income generation.

The need for immediate cash has caused individuals and communities to overfish their area as well as influencing Pacific Island governments to allow large-scale foreign fishing companies to extract marine resources in the deep oceans without adequate monitoring and regulation. Although a significant source of income may be derived from such activities, they are short-term if not conducted sustainably.

The USP Institute of Marine Studies runs a series of village-based workshops to discuss issues of protecting surrounding coral reefs. Cook Islands installed a number of anchor spots for tourism and fishing boats, and created village-based bans on fishing to ensure the survival of endangered fish stocks.

People in communities that rely heavily on coastal and marine resources for food and income, can become involved by assessing any changes in resource availability over the last 10 to 20 years. Some of the questions that can be examined include:

Have you noticed that certain fish that were abundant five or ten years ago are scarcely found today?

- Do you have to go out further to catch fish?
- Have certain marine resources disappeared from your fishing ground?
- If you answered yes to any of these questions, then there is a possibility that the fishing practices as currently practiced are not sustainable.

The role of women in fisheries

Women play a critical role in both subsistence fisheries and small-scale commercial fisheries in the Pacific. In most countries of the region, women's harvesting activities:

- 1) provide regular and affordable protein for their families, and
- 2) supply food for non-rural families through their sale at domestic urban markets.

Women's involvement in fisheries activities is often overlooked by national and regional policy makers, and women are rarely consulted or informed about fisheries development and management issues or plans.

Why is it important to consider women in fisheries?

It is important to understand the role women play in fisheries in the Pacific, and to consider their activities when designing management strategies for marine resources. The species that women collect, and the areas they collect from, are some of the most overexploited in the Pacific. Women's harvesting activities are important for household food and economic security, but they also have an increasing impact on inshore resources. Continuing to overlook the role of women will make it impossible to sustainably manage the inshore resources many communities are so dependent on. Women's involvement in fisheries activities includes:

- fishing almost daily;
- fishing for the family;
- fishing to sell to local markets;
- doing most of the post-harvest activities;
- looking after the family while the men go fishing;
- familiarity with the marine resources and habitat of the inshore areas; and
- passing on their marine environmental knowledge to children.



Women going fishing.

Activity

1. List all the daily tasks and the times taken for each task for the men in your family.
2. List all the daily tasks and the times taken for each task for the women in your family.
3. Work out how much time is spent on each task as a percentage of the total tasks for both men and women.
4. Draw a pie chart for men's tasks and a pie chart for women's tasks.
5. Discuss the differences in activities performed by men and women.



Women digging for worm to use as bait.

Gleaning or collecting

Women glean from inshore areas collecting shellfish, sea urchins, sea cucumbers and other marine species. Women also look for crabs and lobsters in mangrove areas. On the mud flats they dig for shells. On the sand flats and reef flats they use their hands or sticks, and steel rods to dig out shells. Most women carry a basket, bucket or plastic bag to put their catch in.

Women are good fishers, and are quick with their fingers and eyes. They pick up the trails of crabs and octopus and follow them until they catch them or pry them out from their holes or hideouts.

Line fishing

Women often fish with hand lines. Sometimes they stand in knee deep or waist deep water, line fishing for small reef fish. They use worms, other small fish and sometimes shellfish for bait. Octopus make very good bait when cut up into small pieces.

Net fishing

Women also use scoop nets or hand nets to catch fish. Some also use larger gill nets. Many women know the best times to fish, what time the tides are, and when the fish will be moving onto or off the reef. On some islands, women use nets with stone traps, to catch fish that may be going into, or coming out of the traps at the turn of the tide.

Poisonous plants

In some parts of the Pacific, women use poisonous plants or vines to catch fish. The vines are crushed on rocks using stones, then squeezed into pools of water in the reef at low tide. This destructive fishing method kills many fish and other marine organisms, not just the ones the women are aiming to catch.

Diving

Women now also dive for sea cucumbers, for the valuable beche-de-mer export fishery, using a mask and snorkel.

Activity

1. How do you collect shellfish?
2. How do you recognise an octopus trail?
3. If an octopus sees you, it will hide in its lair - how can you get it out?
4. How do women find shellfish that are buried in the sand or mud?

Processing

Women process their own catch, as well as the men's fish catches. In the Pacific, there are many ways of processing marine food before they are eaten or taken to the market. Some of these methods are covered in the Community Fisheries Training Pacific Series 6, Seafood Processing. Sometimes fish and other marine resources, such as sea urchins and clams, are eaten raw - the flesh is cut into small pieces, mixed with lemon juice, and eaten.

Some marine resources, such as shellfish or sea plants, can be kept in tidal pools on the shoreline until it is time to take them to the market. Others must be boiled, smoked, dried or kept in the refrigerator.

Women know many ways of preparing fish and other marine animals for eating. Different species are prepared in different ways - they can be cooked in coconut cream, smoked, boiled or cooked in an underground oven.

Activity

1. How are sea plants kept fresh for the market?
2. Do people in your country dry fish? How are they dried?
3. When women catch octopus, they beat the octopus on a rock or on sand. Why do they do this?
4. When women collect shellfish, where do they keep the shellfish before taking them to the market?

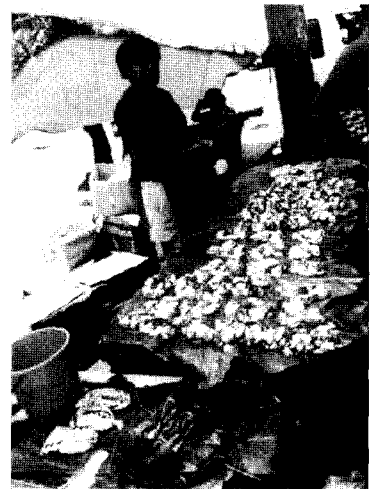
Distribution and marketing

Most of the distribution and marketing of marine products in the Pacific is done by women. Distribution includes taking marine products to:

- relatives;
- other households who helped in the harvesting;
- roadside stalls and other outlets to be sold; and
- restaurants, hotels and buyers.

Fish or shellfish must be kept in good condition before they can be sold or given away. Considerable care is taken to see that fish and other seafood do not go bad.

Marketing seafood is predominantly done by women. Fish, shellfish and a wide range of other seafood including octopus, sea plants and sea cucumbers are sold by women in local markets throughout the Pacific. Sea plants are displayed in piles, and wrapped in leaves when sold. Fish are sold singly, in bundles, strings, or fried or smoked then



A woman selling clams and crabs at the Suva market. Note that the clams are sold in piles.

sold in piles. Octopus is boiled, dried and sold in piles. Shellfish are sold in piles or basketfuls. On Saturday, which is market day throughout the Pacific, women can be seen sitting at the market trying to sell their catch to customers. Most come very early in the morning to find a good spot before the market opens for the public at 5 or 6 a.m. People from rural communities and from villages who now live and work in towns are the main buyers of the seafood. Even though they live in town and may not have access to fishing areas, or the time to go harvesting, they still retain the taste for fresh seafood.

Activity

1. Why do you think women do all the selling at the market?
2. Why do women sprinkle water on seafood when selling?
3. What problems do you think women who sell in the market face?

Management

For successful management at the village level, women should be involved in management planning, implementation and monitoring. It would be a shame to waste their knowledge and also women are strong supporters of management initiatives; have their own groups in communities which can be used in management initiatives; and will involve the whole community when they become involved in fisheries management.

Activity

1. List three reasons why women should be involved in any marine management initiative?
2. Why is their involvement important?
3. How do they know about the tides, moons, winds and seasons that affect fishing?

Do women make decisions in the community?

In some Pacific Island countries, women hold important positions and are involved in decision making. However this is not always the case. Mostly women in the Pacific do not have the decision-making powers that women in western parts of the world have. This can be because:

- of cultural restrictions;
- men are usually seen as the decision makers;
- women are usually not included in meetings or official gatherings;
- women are usually busy providing food for the visitors; and
- women are not usually expected to speak out in public.



Women actively participating in community planning activities.

However, Pacific Island society is undergoing changes. One change is the status of women in decision making. Women are becoming more and more involved in decision making through:

- education;
- women's networks;
- NGOs and other organisations; and
- community participation initiatives.

A lot of the work that NGOs do in communities today involve women. Women are part of the planning and training group. When doing participatory activities, women from the communities take the lead in teaching and taking part in all the activities.

Activity

1. What are some of the reasons women do not fully participate in decision making?
2. List some cultural taboos faced by women in your community.
3. Do you think women should be involved in decision making? Why?

Improving the role of women

Source: Tony Chamberlain, Pacem in Maribus XXVII Conference, Marine Studies Programme, University of the South Pacific, 15 November 1999.

Background

1. There is an acute shortage of post-harvest expertise at all levels in the region, especially women's expertise.
2. Women provide the bulk of the processing and marketing force.
3. There is a lack of women's involvement in commercial enterprises and new areas of fishing.
4. There is an increase in fishing pressure due to commercialisation.
5. Women are often not involved in decision-making processes. Two main areas of disempowerment are:
 - I. In fisheries departments, because there are many more men than women (disempowerment by numbers)
 - II. By the customary/traditional processes - traditional divisions of labour compromise women's position. Women's roles in the family and community are often seen as less important.

Training

1. Women often don't get the opportunity to attend workshops because of their household responsibilities.
2. More money needs to be allocated to training women (currently most training goes to men).

3. Single-sex training is thought to be more favourable than mixed-sex training. This is because harvesting and post-harvest techniques used often differ between sexes, therefore there are unique training and development needs.
4. More training is needed for small-income generating activities. There is a firm belief that money equates to empowerment.
5. More training is sought in fish smoking and drying. In Fiji Islands alone these processes were seen as a dwindling method of fish processing and value-adding.
6. More training in conservation of marine resources. It was encouraging to see the keen interest in conservation and the desire to learn more about both traditional and modern methods of conservation.
7. More education and training to enhance women's job opportunities in the commercial sectors. There is a lack of opportunities for women in emerging and existing commercial fisheries. Training in processing techniques, value-adding, quality control and food safety are sought.

Research

1. Studies are needed on how to harvest 'just enough' (i.e. not to over-harvest).
2. Studies are needed on the value of women's labour that is channelled into producing fisheries products. 'Do prices properly reflect the effort and opportunity costs that women contribute in getting the fish to the market?'

Mechanisms

1. There is a lack of formal structure for women's processing and marketing.
2. Women can form informal groups and networks.
3. Women should be more involved in diversified activities.
4. Women need more real, meaningful participation in community management.
5. Women need to recognise the networks/organisation/groups that already exist.
6. There needs to be more follow-up activity associated with development activities for women in fisheries.

Women often want more training for women only. Government should assist by providing this training. If money and opportunities were made available specifically for women, the customary/traditional obstacles to their personal development would be overcome.

Community-based fisheries management

In most, if not all, Pacific Island countries, the total weight of seafood caught in subsistence - or village - fisheries is greater than that from commercial fisheries. When a nominal value per kilogram is put on the subsistence catch, it is often found to be of greater value than commercial catches.

Subsistence fisheries are important in providing food for local people. Locally caught seafood decreases a country's reliance on cheap, low quality protein imported from overseas.

Despite the importance of subsistence fisheries, most fisheries agencies devote the majority of their time and resources to commercial fisheries. Most countries have national fisheries regulations and, although these may be applied in urban areas, they are rarely enforced in village areas. Subsistence fisheries are difficult to manage. They are made up of a large number of people using many different fishing methods to take small individual catches of a great variety of species.

So how should we manage our important subsistence fisheries? One way is to foster the attitudes of fisheries agencies to encourage and support fishing communities to manage their own fisheries resources. The community is encouraged to define its own problems with fish stocks and the marine environment and propose solutions to these problems. The community sets its own conservation rules, and it (rather than the government) has ownership of the rules and a responsibility to enforce them. Because communities play the key role, this type of management is referred to as community-based fisheries management, and can be defined as arrangements under which a community takes prime responsibility for managing its fisheries resources.

Community involvement results in community ownership of fisheries management actions and regulations. If communities make their own conservation laws, as they have historically done in the past, they are more likely to respect them. Under community ownership, fisheries management measures are enforced by communities themselves.

Principles of community-based fisheries management

Empowerment

Empowerment is the ability or power to exercise management control of resources to improve well-being and to ensure sustainable use of resources. Communities that have access and control over their fisheries resources are said to be empowered. The successful management of these resources by a community means there is a better chance that any economic gain from a resource is shared among the community. Empowerment also means building the capacity and skills of a community to efficiently manage their resources in a sustainable way.

Equity

Equity means there is equal access to opportunities among individuals within a community. Equity is said to exist if all small-scale fishers have equal access to the benefits that result from the development, protection and management of fisheries resources. By ensuring the protection and conservation of fisheries resources, equity is maintained for present and future generations of fishers.

Ecological soundness and sustainable development

Community-based fisheries resource management promotes technologies and practices that are both appropriate for the needs of the community (social, cultural and economic) and are ecologically sound, that is they will not harm the environment. Sustainable development is development that respects the value of the natural environment while pursuing economic benefits that do not compromise the welfare of future generations.

Respect for traditional/indigenous knowledge

Community-based fisheries resource management recognises the value of indigenous knowledge. It encourages the adoption and use of this knowledge in its activities.

Gender-fairness

Community-based fisheries resource management recognises the unique role and contributions of men and women in development, and in improving the well-being of families and communities. It also promotes equal participation of men and women in decision-making and management of fisheries resources.

In order for communities to manage their fisheries resources, they must have:

- an awareness of problems with the marine environment and fisheries resources;
- a concern for these problems and their effects on the community;
- a desire and willingness to take actions to address these problems;
- some control over their adjacent fishing areas or customary marine tenure (CMT); and
- the traditional power or organisation to make and enforce their own regulations.

Activity – Customary marine tenure

1. In your country, what traditional controls do village communities have?
2. List details of traditional and current ownership of marine areas.

Setting up a community-based fisheries management programme involves defining a goal and a strategy. The goal refers to the result(s) being aimed for and the strategy defines the principles or overall plan under which the goal is to be achieved. For example, the goal may be for a particular number of villages to effectively manage their own fisheries resources. One of the possible strategies to achieve this goal would be to encourage each participating village to develop its own village fisheries management plan.

Before embarking on a community-based fisheries management programme, the level of community awareness must be assessed. If community awareness is considered to be low, greater efforts will be needed to raise public awareness. However, care should be taken not to underestimate community knowledge. The use of damaging fishing methods such as dynamiting, does not necessarily indicate community ignorance; it may mean that such methods are used and condoned for economic reasons - the use of dynamite may result in large fish catches in the short term, even if the long-term result is destroyed coral reefs and reduced fish stocks.

Preparation for a fisheries extension programme consists of designing a culturally appropriate extension process, and training extension staff to facilitate the process effectively. The extension process has to be designed specifically to encourage communities to discuss problems and propose solutions relating to fisheries and the marine environment. A generalised model is given in the SPC manual *Fisheries Management by Communities: A manual on promoting the management of subsistence fisheries by Pacific Island Communities*. The process is briefly outlined in the diagram below.

Government attitudes to fisheries management by communities

When embarking on a community-based programme, it may be necessary to overcome an initial government reluctance. Government authorities may have concerns about a programme that encourages village communities to take actions for which they (government authorities) see themselves responsible for.

Fisheries agencies, as the holders of technical and scientific expertise, have historically assumed responsibility for taking actions and setting national laws to protect fish stocks and the marine environment. Consequently, a government fisheries agency may feel a loss of power, or that it is avoiding its own responsibility, by placing the initiative for marine conservation in the hands of fishing communities. However, experience suggests that a government agency that promotes community management gains in many ways.

Tools for involving the community in management

Go to the people, live
With them, learn from
Them, start with what
They know, build with
What they have. But
With the best leaders,
When the work is done,
The task accomplished,
The people will say,
"We have done this ourselves"

Lao Tsu, 700 B.C.

In the past, development at the community level was mainly initiated by outside experts from development organisations. The goals of such projects were often set with little or no local consultation. Community consultation, if any, was limited to community leaders who were often older men. For example, women in the Pacific have generally been excluded from decision-making processes regarding such issues as land and sea resource use. Projects, therefore, rarely met community needs effectively.

Considerable attention has been given in the last few years to exploring ways of involving the entire community in problem solving and decision making for community development. Increasingly, development organisations have come to appreciate that involving communities actively in their own development leads to increased participation, builds local capacity, and supports sustainability.

When involving the community, it is useful to gather and share information about certain local topics (for example fisheries resource management) from the experienced and knowledgeable members within the community. Through this, communities learn more about their own environment, and are better able to identify their needs and suggest ways of meeting those needs.

Some examples of sharing information and involving communities in resource management are given in the activities below.

Activity - Coastal resource management questionnaire

Adapt to suit your community's specific needs:

Activity – Seasonal analysis

Objective: To prepare a seasonal calendar of marine resource availability.

1. Discuss and identify the main marine resources that are caught in your community throughout the year.
2. Prepare a table, as shown below.
3. Indicate the availability of each resource (as listed in the left-hand column) by month by shading the appropriate box.

Marine Resource	Calendar Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Vaya (little priest)												
Daniva (herring)												
Sasa (sea pike)												
Buse (garfish)												
Kaboa (eeltail catfish)												
Kaikoso (arkshell)												
Sisici (trochus)												
Nuqa (rabbitfish)												

Activity – Problem tree

Objective: To identify main marine environmental problems in your community and determine causes and possible solutions.

1. Gather a community group and discuss main marine environmental problems that exist.
2. Prepare a problem tree as illustrated below.
3. Consider effects, causes, solutions, target groups and time of implementation.

Words and Their Meaning

Algae	- simple, non-flowering plants without true stems, roots or leaves.
Ballast tanks	- special tanks within ships for holding water for stability - especially when the ship does not have a full load of freight.
Beche-de-mer	- sea cucumbers that have been processed into a dry food product, usually for export.
Bilge	- the lowest part of the interior of a boat, where water (and oil) collects.
Biodegradable	- capable of being decomposed by bacteria or other organisms.
Biology	- the scientific study of living organisms.
Coral bleaching	- the loss of colour and whitening of corals due to stress, including natural and human-induced.
Dinoflagellates	- microscopic, one-celled, plant-like organisms, usually with two tails (flagella).
Ecosystem	- a community of interacting organisms and their environment.
Gender	- refers to different cultural and social roles men and women have in their society.
Genetic diversity	- the variety of genes within a particular species - the larger the number of ancestors, the greater the variety, or diversity. This variety makes the species in general more resistant to diseases or to changing ecological conditions.
Global warming	- the gradual increase in the overall temperature of the earth's atmosphere due to the effect caused by increased levels of carbon dioxide and pollutants.
Habitat	- the natural home or environment of an organism.
Invertebrates	- animals without backbones, such as shellfish or crabs.
Larvae	- an immature form of a fish, shellfish or other animal that undergoes some form of change before growing to the adult form.
Mortality	- the number of deaths in a given area or period, or from a particular cause.
Nutrients	- in the context of the marine environment, dissolved food material (mainly nitrates and phosphates) used by plants.
Participatory	- including all members of the community in the design and implementation of a management or development project.
Phytoplankton	- plankton that captures energy from the sun, much like plants on land.
Plankton	- tiny forms of animal and plant life that drift or float in the sea.
Polyps	- a single member of the group of marine animals including corals, anemones and jellyfish, fixed to a surface by one end, with a mouth surrounded by a ring of tentacles at the other.

Recruitment	- young fish entering the adult fish stock.
Red tide	- red discoloration of seawater caused by a population explosion of toxic red dinoflagellates.
Rehabilitative	- restoring to health or normal conditions.
Salinity	- the level of salt dissolved in water.
Size at first maturity	- the size an individual of a species must reach before it is mature enough to first reproduce.
Spawn	- to release or deposit eggs.
Species	- a classification of living organisms, according to similar characteristics and the ability to interbreed or exchange genes.
Sustainable	- something that can be continued indefinitely.
Unsustainable	- something that can only be done for a short time.
Zooxanthellae	- small plant cells living within coral polyps and the mantle of giant clams.

Related Resources

Chamberlain, A. and A. Jauhary. 1999. Understanding Fisheries Science 2, Educational Development Centre, Ministry of Education, Republic of Maldives.

Clarke, A. 2001. Mangrove/fisheries connections in tropical Australia. Paper presented to the SPREP Regional Workshop on Mangrove Wetland Protection and Sustainable Use. 12–16 June 2001, Suva, Fiji.

ECOWOMAN. 2000. Community environment workshop handbook for women. Pacific Women in Science and Technology Collective, Fiji.

ECOWOMAN. 2000. Participatory learning and action: A trainers guide for the South Pacific. Pacific Women in Science and Technology Collective, Fiji.

Ellison, J.C. 1999. Status report on Pacific Island mangroves. In: L. Eldredge, J.E. Maragos, P.F. Holthus and H.F. Takeuchi (eds). Marine and coastal biodiversity in the tropical island Pacific region. Vol. 2: Population, development, and conservation priorities. Pacific Science Association, East-West Center, Honolulu.

FAO. 1995. Code of Conduct for Responsible Fisheries. Food and Agricultural Organisation of the United Nations, Rome, Italy.

FAO. 1997. Precautionary Approach to Capture Fisheries and Species Introductions. FAO Technical Guidelines for Responsible Fisheries 2. Food and Agricultural Organisation of the United Nations, Rome, Italy.

FAO. 1997. Integration of Fisheries into Coastal Area Management. FAO Technical Guidelines for Responsible Fisheries 3. Food and Agricultural Organisation of the United Nations, Rome, Italy.

FAO. 1997. Fisheries Management. FAO Technical Guidelines for Responsible Fisheries 4. Food and Agricultural Organisation of the United Nations, Rome, Italy.

FAO. 1998. Responsible Fish Utilization. FAO Technical Guidelines for Responsible Fisheries 7. Food and Agricultural Organisation of the United Nations, Rome, Italy.

Gilman, E. 2001. Community-based monitoring and management network for the conservation and wise use of Pacific Island mangroves. Paper presented to the SPREP Regional Workshop on Mangrove Wetland Protection and Sustainable Use, 12–16 June 2001, Suva, Fiji.

Hamilton, L.S. and S.C. Snedaker (eds). 1984. Handbook for mangrove area management. UNEP and East-West Center, Environment and Policy Institute, Honolulu.

ICOD and SPC. 1991. The principles of extension and communication skills: A manual for the fisheries extension officers of the South Pacific Islands. International Centre for Ocean Development, Halifax, Canada; and South Pacific Commission, Noumea, New Caledonia.

IIRR. 1996. Recording and using indigenous knowledge: A manual. International Institute of Rural Reconstruction, Silang, Philippines.

IIRR. 1998. Participatory methods in community-based coastal resource management. 3 vols. International Institute of Rural Reconstruction, Silang, Philippines.

IPS. 1994. Ocean and Coastal Studies: Science of Pacific Island peoples. Volume 1. (Ed.) John Morrison, Paul Geraghty, Linda Crowl, Institute of Pacific Studies, Suva, Fiji.

King, M. 1991. Fisheries in the economy of the South Pacific. Forum Fisheries Agency, Honiara, Solomon Islands.

King, M. 1991. Understanding fisheries in the South Pacific. Forum Fisheries Agency. Institute of Pacific Studies of the University of the South Pacific, Fiji.

King, M.G. and L. Lambeth. 2000. Fisheries Management by Communities. A manual on promoting the management of subsistence fisheries by Pacific Island communities. Secretariat of the Pacific Community: New Caledonia.

Pillai, G. 1985. Mangroves of Fiji: Their uses and management. Paper presented at the Research for Development seminar: The mangrove ecosystem. Australian Institute of Marine Science, 17-25 May 1985, Townsville Australia.

Singh, B. 1996. Fiji. In: R. Jaensch (ed). Wetland Conservation in the Pacific Islands Region. Proceedings of the Regional Workshop on Wetland Protection and Sustainable Use in Oceania, 6–10 June 1994, Port Moresby, Papua New Guinea. Wetlands International – Asia Pacific Publication No. 118, Canberra, Australia.

Thaman, R. and W.C. Clarke (eds). 1993. Agroforestry in the Pacific Islands: Systems for sustainability. United Nations University Press: Tokyo, Japan.

UNESCO Project: Marine science curriculum materials for South Pacific schools:
 Tropical Marine Studies 1. Hopely, J. and O'Brien, J. Pacific Islands: Origins and ecology, 1994.
 Tropical Marine Studies 2. Collins, J. Tropical Shorelines: Biology and ecology, 1995.
 Tropical Marine Studies 3. Musso, B. and Hutchinson, E. Corals and Coral Reefs, 1995.
 Tropical Marine Studies 4. Malony, B. and Sheaves, M. Mangroves, 1995.
 Tropical Marine Studies 5. Collins, J. Oceanography and Plankton, 1995.
 Tropical Marine Studies 6. Zann, L. Caring for the Sea: Fisheries and the marine environment, 1995.

Watling, D. 1995. A mangrove management plan for Fiji (Phase 1). South Pacific Commission: Noumea, New Caledonia; and Fiji Government: Suva, Fiji.

Women and Fisheries Network. 1995. Fishing for Answers: Women and fisheries in the Pacific Islands. (Ed.) Elizabeth Mathews, Women and Fisheries Network, Suva, Fiji.