# Fish Quality Management & Conservation of Marine Fishery Resources

## (A Training Manual)

NETFISH-MPEDA

Network for Fish Quality Management & Sustainable Fishing

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## FISH QUALITY MANAGEMENT

&

## CONSERVATION OF MARINE FISHERY RESOURCES

(A Training Manual)

Network for Fish Quality Management & Sustainable Fishing
(NETFISH)
(A registered society under MPEDA)

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# PREFACE

NETFISH, a registered society under the aegis of The Marine Products Export Development Authority (MPEDA), plays a pivotal role in organizing extension programmes among fisher folk with a view to improving their knowledge in fish quality management and sustainable fishing. The major objectives of NETFISH is capacity building through extension programmes among fishermen and other workers in the fishing and fish processing sectors especially in areas such as quality management, post harvest handling and conservation of fishery resources. Since its inception in the year 2007, NETFISH takes arduous steps in reaching out fishermen to enable them to improve the quality of seafood they produce by way of hygienic handling and observing responsible fishing practises. The State Coordinators and member NGO's are engaged for conducting the training programmes for fishermen. It was felt that the teaching material has to be compiled as a compendium for aiding the trainers. This edition is an attempt towards this objective.

This training manual provides a general understanding of the issues of fish quality management and conservation of marine fishery resources and can be used as a tool for people who are involved in the fisheries extension activities.

I am sure; this publication will be useful to those associated with fisheries extension work.

(Leena Nair I A S)
President NETFISH &
Chairman MPEDA

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CHAPTER 1

# INTRODUCTION AND BACKGROUND

India is gifted with a long coastline of more than 8000 km and enormous prospective to obtain its food from the EEZ of closely 2.02 million sq.km. The country has rich fishery resources with a massive ocean floor, dynamic sea currents and large rivers. Fisheries sector occupies a very important place in the socio-economic development of the country and remains as a source of livelihood for millions of people and an earner of foreign exchange for the country. It is an employment generator as it stimulates growth of a number of subsidiary industries and is a source of cheap and nutritious protein. Fishing has been a traditional occupation in India where both marine and inland fishery has been practiced over decades. There are about 40 lakhs active fishermen engaged directly in fishing in India. Fish production, both marine as well as inland, made rapid progress by the development of technologies in the field of production, transport, storages, processing and marketing. Consequent upon increase in production, export also rose rapidly and achieved great success. Fish and fish products have emerged as the largest group in agricultural exports of India.

Demand for fish products is increasing as a result of population growth and further expansion of trade. At the same time, fisheries encounters complex challenges from habitat degradation, overfishing, overcapacity and illegal, unreported and unregulated fishing and climate change. In addition, failures in governance are also leading to unsustainable levels of exploitation of living aquatic resources and destruction of aquatic ecosystems. The sustainable benefits are in decline, perpetuating a spiral into poverty for many small-scale fishers and communities dependent on fishing. Fisheries, being a vital source of food, employment, trade and economic well being of people, may therefore be conducted in a responsible manner in order to meet the needs of both present and future generations. The development of fisheries translates in to improving the diet of the people, their livelihood as well as country's revenue.

Fisheries management is defined as management actions aimed at conserving the structure and functions of marine ecosystems, in addition to conserving the fishery resources. It implies a governmental system of management rules based on defined objectives and a mix of management means to implement the rules. In India various government and non-government organizations are taking a leading role in the conservation of natural resources and biodiversity by joining hands with the local community. This has been possible through rigorous education campaigns, public participation and joint participation programmes. The main challenges facing fisheries development in the country includes accurate data on assessment of fishery resources and their potential in terms of fish production, development of sustainable technologies for fin and shell fish culture, yield optimization, harvest and post-harvest operations, landing and berthing facilities for fishing vessels and welfare of fishermen. One of the goals of fisheries management is to ensure the quality and sustainability of fish stocks by promoting more sustainable and selective ways of fishing and post harvest

handling. Unfortunately many of our management measures failed to bring out the desired result due to lack of proper planning and implementation. The conventional system of extension through the official machinery needs to be replaced by an agency which can reach out to the grass root levels and mobilize organization whose primary objective to work for the welfare of fishermen. Such an agency will be far more effective in imparting training to fishermen and fish workers and thus bring about a bottom up approach to post harvest handling and sustainable fisheries.

## Role of NETFISH

Network for Fish Quality Management and Sustainable Fishing (NETFISH), is a society formed under the aegis of Marine Products Export Development Authority (MPEDA). NETFISH functions by networking with fishermen societies, federations and non-governmental organizations to impart knowledge to all stakeholders and other beneficiaries of fishery resource on fish quality management, conservation of fish resources as well as sustainable fishing. The overall objective of NETFISH is to improve sustainable livelihoods in the fisheries sector and to make concrete progress towards meeting the goals in fisheries.

NETFISH team comprised of The President, Chief Executive, State coordinators, Research personnel and the member NGO's. Staff of the member NGO's are trained on various fisheries extension programmes with the help of reputed fisheries institutes, universities, departments, etc. These trained trainers are utilized for conducting various extension programmes among fisher folk. The training and awareness programmes were conducted at selected harbours/landing centres, fishermen villages, on board, pre-processing centres, aqua farms, dryfish centres etc along the maritime states of India to achieve the objectives.

NETFISH acquire technical information, including know-how, process operating data, plans designs, blue prints or any other information assistance required for conducting extension training programmes from all available sources and transfer such information to stakeholders through various extension training programmes. It forms a network with stake holder organizations like fishermen's societies, mechanized boat operator's societies, fishermen's federations, etc. organization of processing and pre processing workers all over the country by inducting their representatives in the general body of the society. It also facilitates public or private investment in infrastructure development. NETFISH forge or develop systematic linkages between international, national/state/district institutions of excellence in the field of extension and marketing.

## Training Aspects

With the growing importance of total quality management in seafood production, post harvest handling has assumed paramount importance. Although India has world class seafood processing plants which take care of the final stages of post harvest handling, concerted efforts are lacking in the initial stages of the quality chain. There is a feeling among fishermen that they are completely left out of extension programmes because of the lack of reach. They do not get vital information on the quality requirements in international seafood trade as well as newly emerging areas.

Considering this issue NETFISH's extension training programmes deal with two major aspects. One is Fish Quality Management and the other is Conservation and Sustainable Fishing. Each aspect and the different practices which are to be followed are explained in chapters 2 & 3.

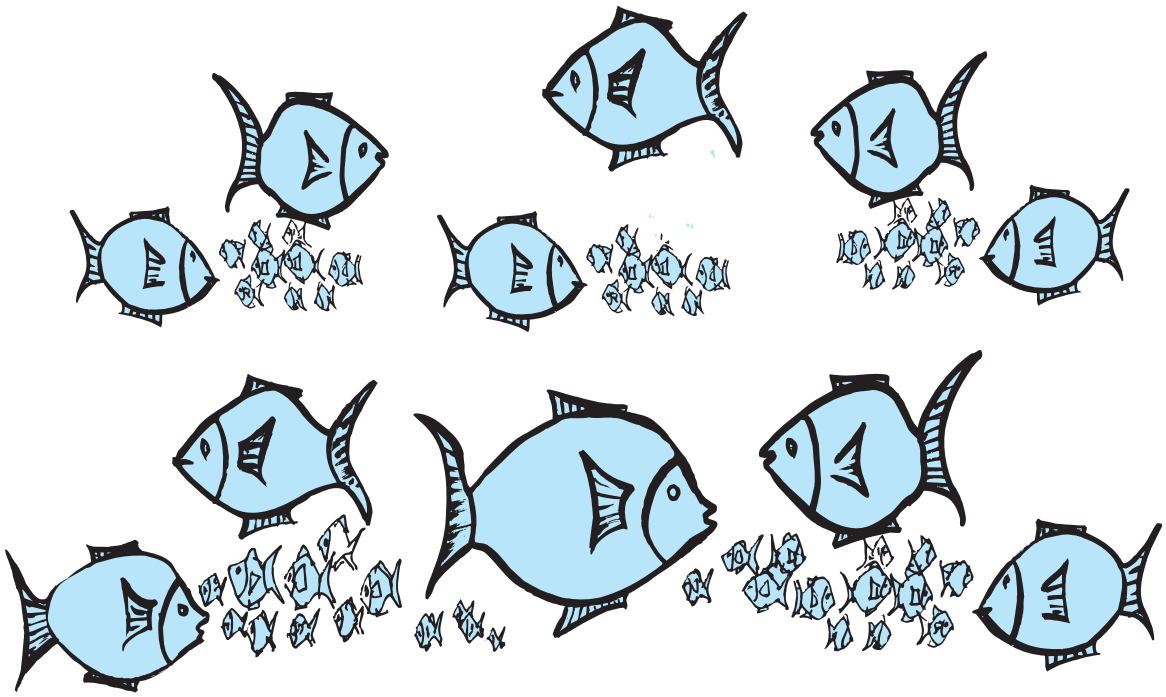
## Purpose of Training Manual

Developing a training manual is important in designing a formal training program. A

training manual ensures that there is consistency in the presentation of the content of the training program. Another major advantage is that all the training information on skills, processes, and other information necessary to perform the tasks is gathered in a single booklet. Training manuals should support the training objectives. Training manuals are particularly useful in the following situations:

- Trainees can use the manuals for reviewing the subject after training.
- It lets the trainee concentrate on and partake in the training during the training session instead of taking detailed notes.
- It can serve as a reference document in the work place.

This Training Manual constitutes a conceptual guide for trainers that can be used to lead them through the issues of extension work and local knowledge which are important elements for fish quality management and sustainable fisheries. The Manual function as a tool for researchers, extensionists and those involved in day-to-day implementation for better guidance on the processes that lead towards sustainable fishery management. Furthermore the manual emphasizes the importance of involving the holders of local knowledge, both men and women in the decision-making process. The entry point to fishery management is people themselves. This participatory process takes time, but it leads to more effective and sustainable results. We strongly believe that a better understanding of the key concepts, and their linkages, will lead to improved planning and implementation.



CHAPTER 2

# FISH QUALITY MANAGEMENT

Quality control and marketing of fish and fishery products are like the two sides of a coin. One cannot do without the other. Quality, in general, means the wholesomeness or the state of excellence of a particular product in terms of its appearance, shape, colour, taste and competitiveness in price to the buyer. In a nutshell, quality means the fulfillment of the customer's requirements. Fish and fish products, being highly perishable, deserve special care and attention from the catching point to the frying-pan. The living habitats of fish are completely different from its post-harvest environments and its quality depends on many factors, such as intrinsic composition, degree of spoilage, damage, deterioration during harvesting, cleaning, washing, handling, preservation, processing, storage, transportation, distribution and marketing. During decomposition, a set of metabolic products are formed, giving rise to intolerable odours. The quality of fish can be better controlled and shelf-life substantially increased through the introduction of a uniform cold-chain system and hygienic handling practices from harvesting to marketing. Each and every person involved in the process should understand and follow certain good practices for the better management of fish quality, which is explained one by one in this section.

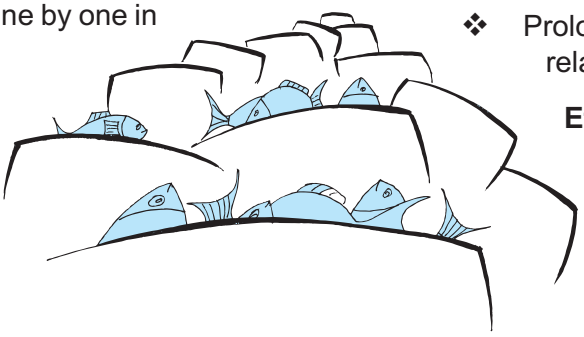
## Ice & Fish

As soon as a fish dies, spoilage begins. Spoilage is the result of a whole series of complicated changes brought about in the dead fish by its own enzymes, by chemical action and by bacteria. Rise in temperature enhances spoilage of fish. The spoilage rate at $5^0$C is twice as fast as that at $0^0$C. So it is very important to keep the temperature of fish low, preferably below $0^0$C.

Icing is the oldest and simplest method of fish preservation. Ice as a cooling medium for fish has a great role in preserving its flavour; it has a very large cooling capacity for a given weight or volume, it is harmless, portable and relatively cheap. The amount of ice required to cool fish and keep it cool will depend upon the insulated options chosen, fish species, ambient temperatures and time of storage. Ice can be produced in different shapes; the most commonly utilized in fish preservation are flake, plate, tube and block ice.

### Advantages of proper icing

- Helps to maintain the temperature of the catch at about 0°C thereby slowing down the microbial and enzymatic spoilage process
- Keeps fish moist thereby preventing surface dehydration and weight loss
- Prolong shelf life of fish as food in a relatively simple way



### Effective Icing

- Use only good quality ice made of potable water, in well maintained ice plants.

- Always store ice in clean containers. Never drag it along floor as it causes contamination
- Avoid large and sharp edged pieces of ice which can damage the fish
- Ice the fish immediately after the harvest
- Use at least 1kg of Ice to preserve 1 kg of fish
- Icing must be to the top and bottom of boxes and preferably with some mixed with the fish to cool the fish more rapidly
- Ensure proper drainage of melted ice water from boxes
- Keep the cold chain till it reaches the consumer

## Onboard

There are about 0.2 million traditional, 45000 motorized and 50000 mechanized vessels in India. The major fishing methods are trawling, purse seining, gill netting, and long lining, among which bottom trawling is the predominant method which contribute to the major share of India's total fish landings.

Fishermen bringing fresh fish of high quality to the shore fetch much better price. Quality management therefore has to start from the moment at which the fish is caught. The deck of boats and other surfaces play major role in keeping the quality of fish. When the fish comes in contact with the unhygienic surface on board, having huge load of microorganisms, it gets contaminated and quality in turn deteriorates. In order to produce high quality products,

the importance of hygienic handling of fish onboard need to be recognized and well followed.

**Before leaving for fishing, ensure,**

- Safety and efficiency of the vessel for operation
- Personal hygiene of each crew member
- Availability of proper cleaning equipments and sanitizers onboard
- Cleanliness of the fish contact surfaces of the vessel
- Availability of enough quantity of good quality ice and water

**Starting off to fishing ground,**

- When the vessel is well clear off the harbour, thoroughly clean deck, utensils and all equipments with sanitizer and then rinse with clean seawater. Use deck hoses only when the vessel is well away from the harbour. Never use harbour water to fill brines, make ice or clean fish holds.
- Allow the deck and equipments to sun dry

**Handling the catch**

- Ensure that all crew members maintain a high standard of personal hygiene while handling fish or containers.
- Hands and other exposed body parts should be thoroughly washed using anti-bacterial detergent before handling the catch. Always wear clean clothes, gloves and gum boots. Cover cuts and

wounds, and do not cough or sneeze on fish or containers. Smoking, drinking and eating at areas where fish is being handled should be prohibited.

- Make sure that the deck is cool and clean before lifting the cod end.
- If the deck is hot, cool it down with a running deck hose to avoid raising the temperature of the fish as this will adversely affect fish quality and reduce shelf life.
- Sort the catch as early as possible in order to protect the fish on deck from sun and wind. It is desirable to use a shade while sorting.
- Take care not to damage fish by walking over the catch, careless use of shovels, etc on deck
- Discard or isolate small, damaged or ink stained fish.
- Pack the sorted fish in separate clean insulated boxes without overloading
- Properly ice the fish using well crushed good quality ice.
- Use 1kg of ice to preserve 1 kg of fish
- Avoid large and sharp edged pieces of ice
- Ensure drainage of ice melted water from boxes
- Quickly transfer the boxes to clean fish holds
- Check fish hold temperatures regularly.
- Keep proper monitoring of fishing time and fish condition
- Maintain a detailed record of each operation
- Catch records should identify the fishing area (by its coordinates), the species of fish caught, their weight, the date/time they were caught, the suitability of fish for use as food when landed, storage details of the catch (to allow for the efficient tracing of any suspect or faulty 'product'), and any general comments.

**On completion of Fishing**

- Clear and clean nets thoroughly after each operation
- Hose all surfaces, utensils and all equipments with clean sea/fresh water. Scrub using a solution of detergent-sanitizer and rinse with clean sea/fresh water. Allow them to dry in the sun and store in clean and dry place
- Clean the remainder of the vessel including wash basins

## Harbours & Landing Centres

Harbours and landing centres are the major sites where the catch is landed from boats and other vessels for auction and sale. It is absolutely necessary that fishermen and other people who handle fish in harbours and landing centres have to follow the basic principles of hygiene and sanitation.

**Personal Hygiene**

- All boat crews, other fish workers, auctioneers and fish traders who handle the fish at harbours and landing centres should follow strict personal hygiene.
- Clean hands and other body parts with good detergent before handling the fish
- Wear clean clothes, gloves and gum boots while handling the fish
- Persons suffering from contagious diseases,

cuts and open wounds should not enter the harbour or landing centres

- Smoking, spitting, chewing pan, eating, etc should be strictly avoided

**Washing and cleaning**

- Always keep the harbours, landing centres and auction halls clean
- Wastes should be deposited only in the areas meant for that
- Thoroughly wash all the fish contact surfaces using sanitizers
- Pressure washing and scrubbing should be practised
- Keep fish contact surfaces free from all type of contaminants like oil, grease, etc
- Cleaning should be done only in the place meant for that and always take care to use fresh water or clean sea water. Never use near shore or near harbour water for cleaning and washing
- Harbours, landing centres and auction halls should be washed with detergents daily after operation
- Cutting, cleaning and processing fish should not be done in harbour

**Unloading**

- Unload the catch as quickly as possible
- Avoiding the hottest parts of the day for unloading
- During loading and unloading, fish should be avoided from contacting with unhygienic surfaces and materials.
- Use thoroughly cleaned plastic basins and crates to handle fish and completely avoid bamboo baskets. Plastics less than 30 microns should not be used
- Non rusted steel shovel should only be used while handling the fish. Care should be taken not to damage the fish while using shovel.
- Unload the catch either on to a clean elevated platform or to clean plastic sheets. Fish should never be allowed to get in contact with floor.
- Fish should be kept in different boxes after sorting. Avoid overfilling of containers to avoid physical damage.
- Containers shall be insulated and provided with cover at all times. Holes should be provided on bottom of the containers to allow draining of melted ice, blood and slime in order to minimize contamination.
- Always maintain the temperature of the material well below 0° by using good quality ice at least in 1:1 ratio.
- After auction immediately remove the fish from the auction hall in proper containers.

## Pre-Processing Centers

Hygienic handling of fishes at pre processing centre is of utmost importance as it is the critical area where steps to the fish processing begin. There are several things to be taken care of

while handling fishes in the pre processing centres.

**Personal hygiene**

- Workers should wear clean uniform, gloves, head gear, mouth piece and gum boots
- They should not bring cloths and belongings into the peeling shed, instead can keep them in the change room
- Hands and legs should be washed, nails should be cleaned carefully and disinfected in chlorine water and dried before entering the peeling shed
- Wash hands before and after using toilets
- Workers with cracks in the skin, wearing damaged hand gloves and having contagious diseases will be the carrier of pathogens. They should not be allowed to handle the fish.
- Smoking and chewing pan masala must strictly be prohibited in the plant
- Avoid nail polishing
- Never wear ornaments while handling fish

**Requirements**

- Pre processing plant should have a compound wall and gate to prevent the entry of wandering animals to the plant premises
- Tyres of the vehicle should be washed before entering the plant to remove the adhered wastes
- There should be a raised receiving area for the unloading of materials properly
- Workers should not enter the peeling shed through receiving window
- Receiving window should be separated from outside by hanging curtains

- Floor and walls of the peeling shed should be tiled so as to enable easy washing
- There should be separate utensil washing area
- The peeling tables should be made of stainless steel
- Vessels used for peeling should be made of either plastic or steel
- There should be hose from peeling table to drainage channel to drain waste water and materials from table
- Waste removing opening should have air curtain to avoid entry of flies and insects
- Nets should be attached to the drainage

channel to prevent the entry of rodents

**Hygienic handling**

- Peeling should only be done on clean tables
- Utensils and equipments should be thoroughly washed before and after use
- Keep the material at cool temperature whole through the process
- The pre-processed material should be kept in ice in closed crates
- Corners of the peeling shed and instruments should be washed using a brush

## Aqua Farms

Majority of our seafood export constitute of shrimps cultured at aqua farms. The demand for aquaculture products are still high both in domestic and export markets. Hence quality management in aqua farms is of prime importance. Proper management of aquafarms throughout the entire production cycle is required for keeping the product in good quality.

**Requirements for better management**

- A well-designed pond will facilitate the management of water exchange, harvesting of the product, waste collection and elimination, and feeding.

- Sufficient supply of good quality water is required. Avoid contaminated or polluted water.
- Before stocking remove all types of wastes from the pond and condition soil and water by applying required quantity of chemicals, aeration etc.
- Water quality need to be observed regularly by checking whether the parameters- Dissolved Oxygen, pH, ammonia, water colour and odour, are in optimum range.
- Wastes from the pond must be collected carefully and dumped into the area meant for that.
- Select good quality healthy fries for stocking and take utmost care while transporting the fries from hatcheries to farm.
- There should be an optimum stocking density depending on the level of production to avoid management problems.
- Use good quality feed and practice good feeding management to improve

production and profit.

- Timely carry out water exchanges to avoid accumulation of wastes.
- Proper drainage and effluent treatment facilities are required for a good farm management.

**Preparations for harvest**

- Provide a shelter / shade for keeping the harvested material protected from direct sun light/ open air.
- Adequate number of clean and well sanitized crates and insulated troughs for chilling and holding the material should be kept ready.
- Adequate quantity of ice made of potable water and crushed using non rusted ice crushers should be kept ready in clean containers.
- Any damage in the main harvesting net should be repaired. The harvesting net should be tied to the outlet frame and this frame should be properly fixed to the groves provided in the outlet.
- Adequate numbers of bag nets for handling the harvested shrimps are to be provided.
- Chilling container should be filled ready with ice and water, very near to the outlet of the pond.
- Enough number of healthy and hygienic labourers should be present well in advance of the harvest.

**Harvesting and handling**

- Successful harvesting can be achieved if the shrimp can be harvested in good condition within a short period of time. Rapid harvesting will reduce the risk of bacterial contamination and the shrimp will still be fresh when reaching the processor.
- The harvesting technique should not damage or excessively contaminate the shrimp with waste.
- Ponds and outlets should be designed in such a way to enable complete draining in 4-6 hours.
- Cool hours of the day ie. early morning and evening time are best for harvesting.
- The day for harvest should be decided depending on the condition the shrimp. The soft shelled shrimps should be less than 5% at the time of harvest.
- Before harvesting and/or exporting, shrimp should be examined for their health, hygienic quality and safety for consumers. Test for antibiotics should also be done. Unhealthy shrimp should be treated before harvesting or removed during harvesting and processing if the proportion of unhealthy shrimp in the stock is low.
- Catch the harvested shrimps in cod end and transfer them to small bag nets in small quantity to prevent damage.
- The harvested shrimp can be chill killed by dipping in iced water to prevent damage and to improve storage.
- Segregate the shrimps and grade them according to size as early as possible.
- Grading should be done on a clean table and shrimps should never come in to contact with the floor. Workers involved in grading the shrimps should wear hand gloves, nose & mouth masks, head caps and gum boots.
- Weigh the graded shrimps and note down

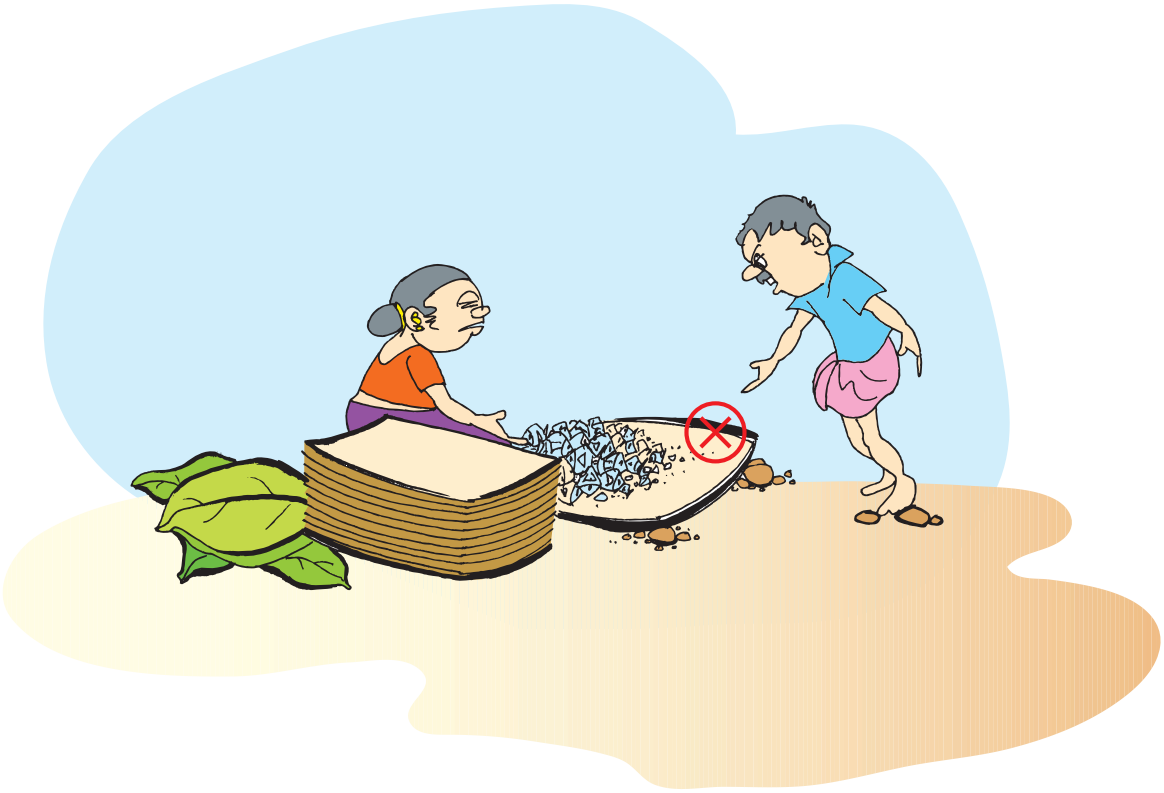
the total quantity.

- After weighing immediately transfer the material to clean plastic containers.
- Ice the material at the ratio of 2: 1 ie. 2kg of ice for 1 kg of shrimp.
- Do not overfill the containers
- Shovels used to handle shrimps should not cause any damage to the shrimps. Steel shovels without rust is best recommended.
- Ensure clear drainage of melted ice water from the packing crates.
- Transport the iced shrimps to processing plants using insulated vehicles and always maintain the raw shrimp's temperature well below 4° C.
- Strict sanitation and personal hygiene of the workers should be maintained all through the process.
- It is the responsibility of every aqua farmer to produce good quality products and ensure the safety of aquaculture foods for human consumers.

## Fish Markets

### A safe seller

- should be in clean clothing and wearing hair coverings
- should be wearing disposable gloves when handling fish
- should not be smoking or eating while selling fish
- should not be sick or have any open wounds



**Requirements**

- The fish market and its premises should be kept clean, free of litter and in good condition.
- Sufficiently lit, well ventilated and well cleaned areas, free from contaminants should be used for selling the catch.
- The sales stall should be built of solid, non-corrosive material and should be of sufficient height for easy sanitization.
- Equipment should be made of stainless steel for easy cleaning and disinfecting, as often as necessary.
- Utensils such as cutting knives, cutting boards, scissors, and others should be clean, non-corrosive, non-absorbent and free from cracks and defects.
- Water should be potable and sufficient at all times
- Water storage tanks, drums, etc should be cleaned and covered
- Waste water must be adequately disposed off and not pose a hazard to potable water, fish, surrounding area or fish handlers.
- Equipment and other containers previously used for substances that are toxic or harmful to human health, such as insecticides, paints or motor oil should not be used for handling fish and fishery products.
- When not in use, the sales stall should be kept covered and in the case of a mobile structure should be kept in a clean place.
- The outdoor sales stall should not be used for any other purpose that could result in contamination of the commodity.
- The sales stall should be free from personal belongings, such as clothes, footwear, blankets, tobacco and other forms of contaminants.
- Sales stalls for displaying fresh fish should be kept clean and sanitized at all times.

**Good Handling Practices**

- Fish should be displayed on clean tables, shelves, boxes and storage space that is smooth and made of non-contaminating materials like plastic and stainless steel
- Fish should be arranged with the bellies down so that the melting ice drains away from the fish, thus reducing the chances of spoilage
- Fresh fish should be kept away from non-edible products like soap, disinfectants, pesticides and other toxic or poisonous substances.
- Withdrawal of fresh fish for sale shall be on a first come first go basis
- Clean fresh fish and fishery products, removing undesirable parts, when necessary.
- Avoid excessive exposure of fresh fish and fishery products to room temperature without ice.
- Fish that shows quality deterioration such as soft body, sunken eyes, severe loss of scales; bad odor shall not be sold.
- Cutting boards used in the preparation of fish shall be made of even, non-fibrous materials, easily cleaned materials and free from cracks and crevices.
- Fish sold shall be wrapped in unused non-contaminating paper and/or plastic. The use of printed plastic/paper is forbidden because the ink may contaminate the fish

- Fish wastes (entrails, scales, etc.) shall be properly collected and disposed.
- Use of harmful substance like formalin for treatment of fish and shellfish meat are prohibited.

## Dry Fish Centres

Fish drying is one of the oldest known preservation methods, and dried fish has a storage life of several years. Much of the catch of small fish species is heavily salted and sun-dried, but there is a high level of spoilage due to unsuitable drying conditions, poor handling and packaging, insect attack etc.

Sun drying is the simplest and primitive drying process. The basic method of sun-drying fish is to spread them on the ground, rocks or a sandy beach, or roadsides. Using this technique, drying can be slow and the fish is easily spoilt. This method is liable to contamination with sand and micro-organisms. It also renders the fish prone to attack by pets and other domestic animals such as goats, sheep, pigs and rodents. Traditional sun drying leads to quality loss due to oxidation, rancidity, spoilage and contamination.

- It is advised to use clean plastic sheets to keep the fish for drying. Drying should be done only at the area meant for that. Fish must be dried quickly in currents of air and protected from insects and dirt.
- Rack drying or hang drying method limit contamination due to less contact with dust, sand, domestic animals etc. Other advantages are reduction in losses, a higher quality product, a shorter drying time, a cleaner product
- It is sensible to shift to modern technologies for drying fishes like solar tent drier, solar cabinet drier, solar dome drier and solar drier with a separate collecting and drying chamber. These driers are efficient in achieving higher drying temperatures and reduced humidity. They also increase drying rates, producing lower moisture content in the final product and highly improved quality. This method limits infestation of fly larvae and other insects and other contaminants.
- Proper packaging of dried fish using plastic films, cellophane, flexible laminated multilayered film packing, open-top sanitary cans, retortable pouches, modified atmosphere packaging, fiber and plastic corrugated fiberboard boxes is important as it facilitates handling during storage and distribution within the marketing chain.

CHAPTER 3

# SUSTAINABLE FISHING AND CONSERVATION OF FISHERY RESOURCES

Indian marine fisheries field experiences serious threats regarding its conservation and sustainability. The highly productive inshore area is being exploited intensively by mechanized boats and traditional crafts. The fishing pressure exerted by the increasing number of crafts using innovative gears in the narrow near-shore regions has resulted in heavy competition leading to inter- and intra-sectoral conflicts. Active fishing with synthetic fibers, propulsion with outboard motors and modification of craft and gears, including indigenization of fishing techniques such as mini purse-seining and mini-trawling, have contributed to the overfishing. This has also coincided with an enormous increase in fishing by the mechanized sector, which has led to large scale destruction of egg bearing and juvenile fishes. Following are the major area of concern.

## Overfishing

Fishing activities have various negative impacts on marine ecosystems. The greatest concern is the rapid depletion of fish population due to extensive commercial fishing. A full one-fourth of the total catch is not those targeted and often is discarded. Overfishing occurs when fish are caught faster than they can reproduce, and according to many scientists it has become one of the greatest impacts of human activity on oceans. Overfishing increases the vulnerability of ocean ecosystems and may contribute to the decline of other marine species including birds and mammals.

According to the Food and Agriculture Organization of the United Nations (FAO), 47% of global fish stocks are fully exploited, thus offering no reasonable expectations for further expansion, and another 18% are reported as overexploited. Major changes in the composition of global catch to species of lower economic values have been reported, since high-demand species are being captured even in their immature stage. As harvest shrink, the prices of most fish species continue to rise, making fish a less affordable food source among low-income populations.

Overexploitation takes place when the maximum amount of fish that can be taken from the sea is exceeded. The improvement in efficient fishing technology, that is becoming available to even smaller fishing operators, is really not giving the fish in the sea much chance to escape the fishing gear and time to reproduce. Biological overexploitation of

fishery resources leads to collapse of certain fisheries or their severe depletion. According to Hutchings (2000), with the exception of a few species, recovery of most fishing stock after collapse is very little. National and international efforts are, therefore, needed to protect fish stocks under threat of overexploitation and to allow depleted stocks to recover.

The major reasons for resource decline are

**1. Technology**

Today fishing technology is highly elaborate. Fishing lines can reach as much as 120 km, furnished with thousands of hooks. Some trawlers reach 170 metres in length and can take on board the volume equivalent of 12 jumbo-jets, and drift-nets can exceed 60 km in length. Fishing vessels cover large distances at high speed, from coastal zone to high seas. They fish at great depth and stay at sea for several days. Destructive to the sea-bed habitat bottom trawling, involves powerful boats dragging heavy, metal weighed nets across the ocean floor to catch the maximum possible amount of bottom-dwelling life. Navigation apparatuses, such as Global Positioning System (GPS) and radar allow boats to constantly reconsider the best fishing spot, with high precision. Fresh fish is a highly perishable product and its consumption was traditionally limited to coastal areas. With modern transport and food preservation technologies, one can offer fresh fish during all seasons, anywhere in the world.

**2. Open access and over-capacity**

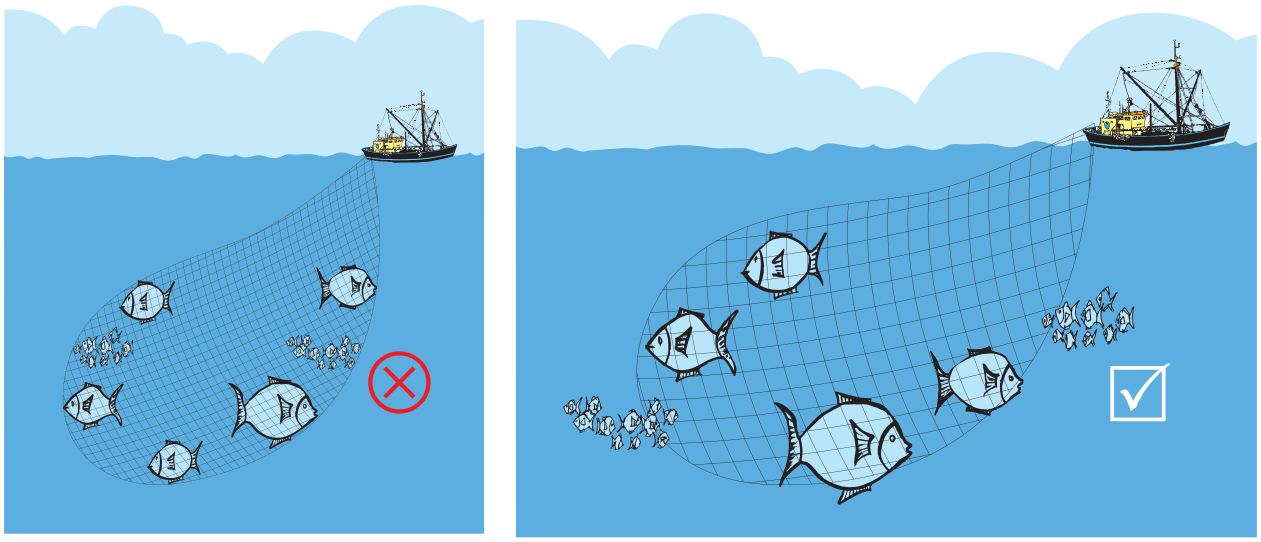
Over-capacity is the presence of too many vessels in a growing number of fisheries. Fish stocks have generally been considered common property, open to exploitation by anyone with a boat and gear as long as they were used outside a country's 200 Mile Exclusive Economic Zone. If enough fish are caught to cover operating costs, there is little economic incentive to stop fishing once a vessel is built. As more fishermen enter the system, greater effort is required to catch a dwindling supply and revenues fall. In time, fish stocks can be severely depleted. Excessive fishing capacity leads to overfishing and therefore to the degradation of fishery resources. Such unsustainable practices, creating a conflict between short-term and long-term gains, lead to serious impacts on biodiversity and diminish vital food production potential for a number of developing countries.

**3. Increased number of vessels operates in same area**

Highly productive ecosystems like coral reefs, mangroves and fish breeding grounds are over exploited by increased number of boats leading to the collapse of the ecosystem in the long run. Destruction of these vital ecosystems will lead to a state where there are no fish in our seas.

Overfishing leads to food insecurity. In India, majority of its rural population depend on fish and seafood as their major source of animal protein. The United Nations Educational, Scientific and Cultural Organisation (UNESCO) warns that fish, long regarded as the "poor man's protein", is diminishing globally as a result of increasing market demand and overfishing. While citizens of developed nations have average annual supplies of about 26kg of seafood per person, people in developing countries have only nine kg per person/year. For people who are highly dependent on fish in their diets, uncertain supplies increase their vulnerability. Moreover, in the next 30 years, more than 6.3 billion people are expected to make their home in already densely populated coastal zones world-wide. Coastal population growth often results in an ongoing increase in the number of people fishing in depleted near-shore areas.

## Juvenile Fishing



A large quantity of low value, smaller size fishes are landed during trawling. This low value, smaller size fishes are commonly termed as juveniles. They are also called by-catch as they are non-target fishes, caught extra in a fishing operation. By-catch is composed of various species of fishes. Juveniles of these varieties are caught before they attain maturity and this severely affects the fish population. As a consequence, the total size of the fish stock decreases year after year.

The practice of making dry fish and fishmeal out of juveniles being caught is widespread. Such practices not only lead to reduction in the quality of fish but also make them low value. If we allow juveniles to attain maturity sizes, you can get several times higher returns in future. Nearly 232 non-targeted species are found killed and discarded in varying proportions. This affects the juvenile population and in the long run may bring about a disaster in the fishing industry making it unsustainable and uneconomical.

### Do's

- Use square mesh panels in trawl cod ends to allow juveniles to escape.
- Use selective fishing gears such as gill nets, long lines and traps etc which selectively target fishes.
- Use low energy fishing gears, Eg. gill nets and long lines
- Fix cod end mesh size to the recommended level.
- Adapt yourself to the sustainable fishing method rather than someone enforces it.
- Compel and convince your fellow fishermen on the importance of avoiding juvenile fishing.

### Don'ts

- Don't use diamond meshed trawl nets that increase fuel cost and catch more juveniles.
- Don't practice wild seed collection
- Don't bring juveniles that are being caught to shore but release them back to sea.
- Don't use mesh size smaller than legally permitted.

- ❖ Don't associate with fishmeal industry that uses juveniles
- ❖ Don't do fishing in protected and fish breeding areas.

## By-Catch

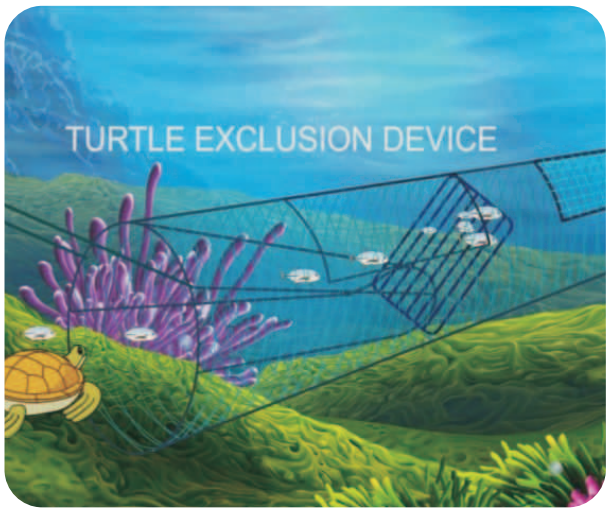
The word "by-catch" refers to the portion of marine life caught that was not targeted. It may include low-value species but also vast quantity of young or undersized fish of valuable commercial species. Almost 25% of all the fish pulled from the sea never reaches the market. Globally an average of 27 million tonnes of unwanted fish is thrown back each year, and a large portion does not survive. Sometimes by-catch fish are kept for the market, but most often they are thrown back dead, because they may be the wrong species of the wrong size, of inferior quality, or surplus to the fishing operations quotas. The potential effects of by-catch are not just for commercial fish stocks, but the entire diversity of species in marine ecosystem sand essential food chain components. Bottom trawling nets are indiscriminate and tend to pick up everything in their path with an extremely high by-catch rate. For example, up to 95% of the take in trawling can be by-catch, which include a variety of endangered or overfished species.

In response to these by-catch issues, the field of fishing technology altered its focus to selective fishing of target species. The current practice of trawlers throwing the unwanted fish catch back into the sea creates pressure on the fish resources. It is necessary to explore ways of reducing the by catch from trawling and make it more target specific. Gill nets and long line cause low disturbance to the bottom fauna and the ecosystem as a whole. Fishermen should adopt these eco-friendly fishing method in place of the destructive fishing practices which leave an irreparable damage to the marine environment. These fishing gears are highly target specific, non-destructive and can be operated with low power engines.

Stake nets are traditional fish bag nets operated widely in backwaters mainly to catch Penaeid prawns. As stake nets are a non-selective gear, huge quantities of juveniles are removed by stake nets thereby reducing the stock. The cod end mesh size of stake net should be maintained to allow juveniles to escape. It is estimated that 94 per cent of the bottom trawlers are having Cod-end mesh size of 18 mm and below instead of 35 mm imposed by the Government. 232 non-targeted species are found killed and discarded in varying proportions while trawling.

**How to reduce By Catch?**

- ❖ Use selective fishing gears like gill nets, long lines and traps to reduce by-catch.
- ❖ Use improved fishing technologies like fixing Turtle Exclusion Device (TED) in trawl nets to allow the escapement of turtles.




- ❖ By-catch Reduction Devices (BRD) - a square mesh panel in the trawl net allows the escapement of juveniles. In addition square mesh reduces friction and save fuel.
- ❖ A reduction of trawling during breeding

season will prevent destruction of eggs and juveniles of commercially important fish.

- The statutory 35mm mesh size for trawl Cod-ends should be strictly followed by the fishermen.
- Modify the design and operation of trawl gears to make bottom trawling more eco-friendly.

## Destructive Fishing

Destructive fishing practices like the use of cyanides and explosives for fishing in many parts of India cause the destruction of many of our beautiful ecosystems like coral reefs and mangroves. These non selective illegal fishing practices not only kill sometimes the entire fauna and flora of an ecosystem but also damage to the ocean floor.

The main destructive fishing methods follows in India are

- Use of poisons
- Use of explosives

**Solution**

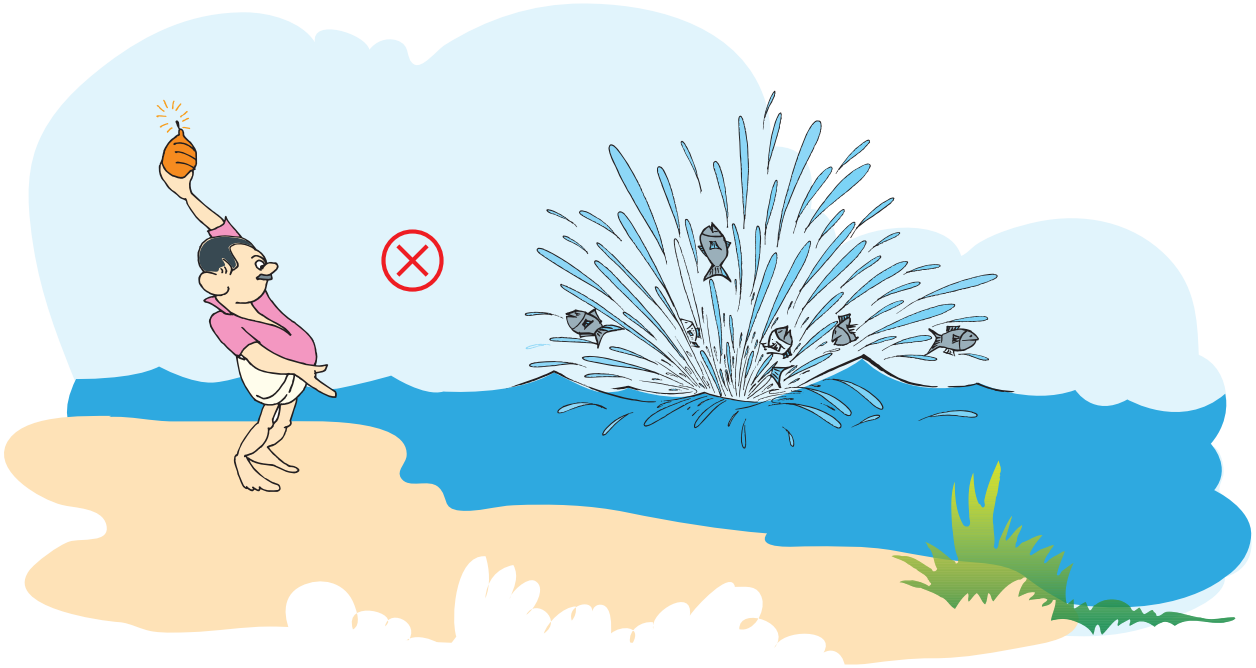
- Completely avoid destructive fishing practices that destroy organisms, environment and us.

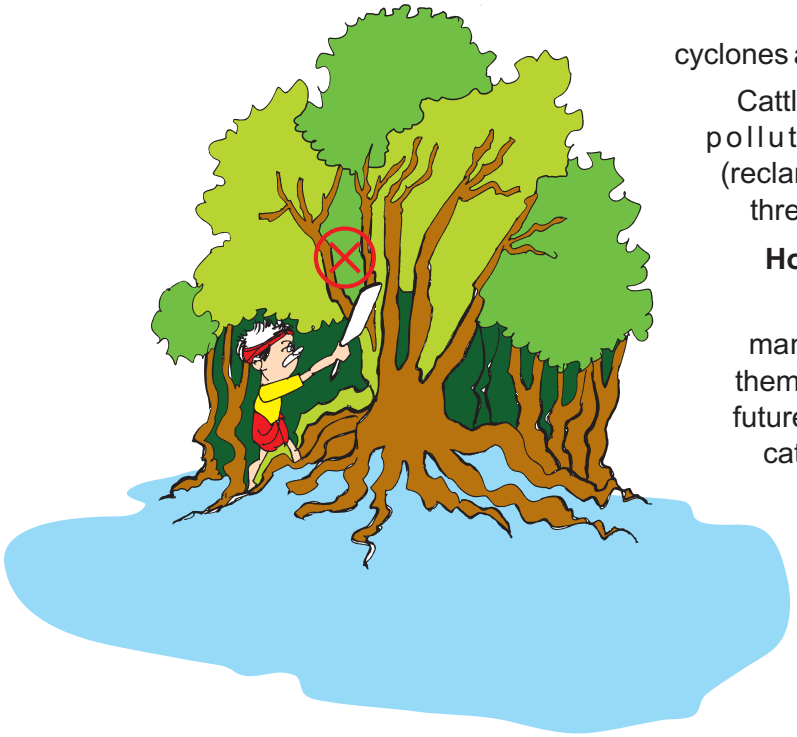
## Mangroves

Mangroves are trees and shrubs grow in salt water environment found mainly in hot climatic regions. In India Mangrove covers an area of 3566 km2, found along the east and west coast. The largest mangrove cover of Sunder ban in west Bengal harbours a variety of living organisms from tiger to turtle. These are highly productive but extremely sensitive and fragile.

**Importance**

- Mangrove plants protect shore from wave action and erosion during rough seasons.
- Mangrove plants provide more nutrients to the adjoining coastal waters so that they





serve as a breeding and feeding ground for a variety of marine organisms including fishes.

- Timber obtained from mangrove trees are used for making furniture and handicrafts.
- Mangrove area serves as an important fishing ground for the traditional fishermen who live side by side with mangrove environment.
- Mangrove plants serve as a source for new medicine development and formulation.
- Act as the nursery grounds for fish and other organisms.

**Threats**

Threats are mainly of two types

1. Natural
2. Anthropogenic

Natural threats include climatic changes, cyclones and tsunamis.

Cattle grazing, agriculture, aquaculture, pollution, human encroachment (reclamation), etc. are the anthropogenic threats.

**How to protect mangroves?**

It is essential to conserve the mangrove ecosystem and manage them for the use of human beings in future. The management issues are categorized into two.

**1. Conservation of the Mangrove ecosystem**

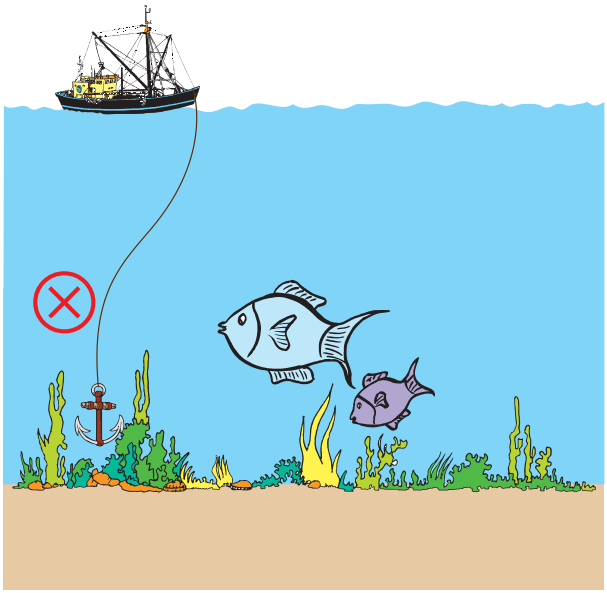
- Grow mangrove plants along the coastline to increase the nursery grounds for the marine organisms which comes for feeding and breeding.
- Help in formulating Government regulation for the protection of mangrove area. Mobilise community opinion on same platform for the management of mangroves.
- Help the conservation agencies involved in mangrove protection to continuously assess the area of mangrove to check the destruction.
- Mobilise your communities on the need to develop parks and reserve areas to protect Mangrove vegetation.

**2 Sustainable use of Mangrove wealth**

- Agriculture, aquaculture, capture fisheries, culture fisheries activities should be conducted without destroying the mangrove environment. For example wild collection of juveniles of prawns is practiced in some parts of the country in mangrove area which seriously deplete the prawn fishery.

- ❖ Mangrove plants used to obtain natural medicinal products by making sure that they will be available in future use also.
- ❖ Use of mangrove for timber, honey collection should be done at a level to get the same resources time after time.
- ❖ Traditional communities living around mangrove forest should take part in the activities like mangrove plantation, awareness campaign, and maintenance of mangrove canal to jointly manage the resources along with the government agency.

## Coral Reefs

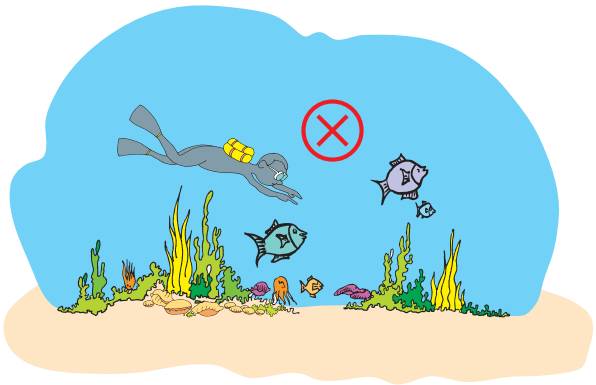


Coral reefs are animals called polyps which have an extended skeleton. A coral reef is composed of hundreds or thousands of these tiny animals growing together as a colony build up on top of each other. They are one of the Earth's most beautiful, ancient and complex ecosystems. They play an essential role in sustaining life in the sea and serve as a source of food and protection for human communities. But coral reefs face an uncertain future. As a result of growing anthropogenic and environmental threats, reefs are among the most threatened ecosystems on earth.

Andaman and Nicobar, Lakshadweep, Gulf of Mannar (Tamilnadu), Gulf of Kutcch (Gujrat) are well known for their coral reefs; Coral patches occur at some intertidal locations and submerged banks on the continental shelf along the west coast. Coral diversity at these sites is generally restricted to few genera

**Importance**

- ❖ Coral reefs are the most diverse communities on the planet.
- ❖ They are one of the earth's most beautiful ecosystems
- ❖ More than 25,000 described species live in reef habitats
- ❖ Many endangered organisms lives in the coral reef ecosystem.
- ❖ Reef formation is very slow so we need to protect them.
- ❖ Coral reefs are often considered the medicine cabinets of the 21st century. They offer great promise for pharmaceuticals now being developed as possible cures for cancer, arthritis, human bacterial infections, viruses and other diseases.
- ❖ Coral reefs protect shore line from erosion and damage



- Coral reefs serves as spawning ground of fishes

**Threats**

- Pollution and over-fishing are the most serious threats to these ecosystems.
- Extensive and poorly managed land development threatens the survival of coral reefs.
- Dynamite fishing is another extremely destructive method that fishermen use to harvest small fish and in turn destroys corals
- Pollution, especially from increased sedimentation (from poor land use) that smothers the coral tissue and nutrients (from runoff) that promote algae growth which, in turn, suffocates the corals.
- Physical damage from tourists, anchors dropped in coral beds, and ships colliding with reefs.
- Alteration of coastline /island habitats, such as deforestation, coastal development and so on.

**Conservation measures**

- Don't pollute, never put garbage or human waste in the water.
- Report dumping or other illegal activities to authorities. Keep it clean. You may be in the habit of picking up your own trash. You may even participate in an organized cleanup. But have you considered carrying away the trash that others have left behind? Only buy marine aquarium fish if you know they have been collected in an ecologically sound manner.
- Don't anchor in the reef.
- If you dive, don't touch! Take only pictures and leave only bubbles! Keep your fins' gear, and hands away from the coral.
- Make sure that sewage from your boat, from others' boats, and from land is correctly treated. The nutrients from sewage feed growing algae can smothen and kill corals.

## Marine Pollution

Marine pollution can be defined as "Introduction by man, directly or indirectly of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of seawater and reduction of amenities.

**Sources**

- Heavy metal pollution
- Oil pollution
- Sewage Pollution
- Dumping waste materials
- Refueling
- Boat repairing
- Boat operations
- Unhygienic fish handling

Sewage pollution: The untreated waste water coming from households is left untreated into the sea creates unsuitable environment for fish and serves as a reservoir of infectious diseases.

Heavy Metal Pollution: Mercury, Cadmium, Chromium are known to accumulate in the muscle of fishes. Discharges with these heavy metasl would pass through food chain and will finally come to humans. These heavy metals

affect nervous system of human and cause various disorders.

Oil pollution: Hull and engine maintenance leave behind large quantity of engine and hydraulic oil.

Toxic components like TBT and copper leach out from paints, toxic wastes from spent batteries and acids, use of non approved refueling operation which is done alongside the jetty, wastes generated through fish handling like gut, skin, scales etc., coastal Litters like plastic and polystyrene boxes and used tyre, ropes and nets are other sources of marine pollution.

**How to avoid this worst scenario**

- ❖ Do not dump waste generated like oil and grease during hull and engine maintenance into the sea.
- ❖ Do not throw plastic cans, nets, tyre and plastic bags into the sea.
- ❖ Avoid untreated sewerage mixing in the fishing harbour/ landing centre area
- ❖ Avoid single use packaging material, rather use plastic, steel or wooden materials.
- ❖ Never throw off waste over board. Floating litter may damage the propeller.
- ❖ Never use harbour water to wash fish.
- ❖ Toxic and non toxic wastes should be disposed off separately.
- ❖ Recycle and reuse are the ways to avoid pollution of any kind
- ❖ Formation of community management societies for the effective implementation of related legislations.

CHAPTER 4

# TOOLS & METHODS

NETFISH has developed and using various tools and methods in its training programmes to convey its message more effectively to the beneficiaries. The conventional method of extension training through oration cannot be so effective always. In order to add variety to the training and reach the fishermen furthermore, NETFISH is using different mass communication techniques which are mentioned in this chapter.

Mass communication techniques involve using the audio-visual and printed media to reach large numbers of people quickly to stimulate their interest. It is one of the most effective ways to alert a large number of people to a sudden emergency. But it is very important that the audience understands the details of the extension messages that are propagated in the mass media. To meet the set extension aims, mass communication techniques should be used in combination with group or individual extension methods or with other mass communication techniques or in one medium alone. The most common mass communication techniques can be broadly grouped into printed media and audio-visual media.

## 1. Printed media

### Newspapers

Newspapers vary according to the type of people that read the paper and according to the type of news that is printed. It is therefore very important to find out which papers are read by the client groups at a certain area. Even different papers may be read within a single community and within a single household. It is very important that the language and style used in the newspaper are understandable to the target groups.

There are many ways fishery extension workers could use newspapers as extension methods.

- Announcements of events, such as fisheries training programmes, medical camps, etc.
- Follow-up reports to inform readers about the results of programmes or meetings.
- Informative articles on related subjects or message that is part of the extension programme, including research findings, experiences of innovative fisher folk can also be included. Such articles should not emphasize only the scientific; they should incorporate human interest as well as any entertaining aspects.

Various NETFISH activities were regularly covered by national as well as regional dailies. In future also News papers can be used as an effective tool to convey the message of NETFISH to beneficiaries in various forms such as news, articles, cartoons, interviews, advertisements and announcements.

### Posters

Posters can be used to provide information on events or a particular topic. Posters leave


more room for drawings, pictures or text making it more colourful and attractive. These can be distributed or pasted in fishing harbours, landing centers, educational institutions and co management society halls depending on the purpose.

The posters developed by NETFISH in ten languages of India on various aspects of fish quality management, conservation and sustainable fishing can be shown and explained during the training programmes and distributed and fixed in the above mentioned places.

**Notice boards**

The notice boards can be used to disseminate news and ideas to a local audience. The State Coordinator can design a written message for a centrally located or a publicly exhibited notice board.

NETFISH can use notice boards in fishing harbours and fishing villages to inform fishermen about the training programmes and various events such as, medical camps, rallies, harbour cleanup programmes, etc.

**Training manual**

Training manual is the reference guide for the extension officers as well as the client groups giving guidelines on how to organize training, topics covered and the tools and techniques can be used.

NETFISH developed training manual is a source material for State Coordinators as well as member NGOs to refer and implement.

**Leaflets and Pamphlets**

Leaflets and pamphlets can be used in many ways in extension programmes. They have the advantages of being low cost, need a short preparation time, and take limited time to get their message across. However, because the explanation on each topic is brief, extra attention should be paid to ensure that the message is relevant and clear to the reader. It is of little use to produce pamphlets on subjects that are well known to the fisher folk or to produce pamphlets in such a way that they give too little information on how to do the activity propagated. The assessment of the exact information needed on a certain topic by certain client groups may well be the most time consuming part of the production of a good pamphlet. This study should be conducted before the pamphlet is produced. The pamphlet should then be written in a simple language that is easily understandable to the client group.

The 13 leaflets developed by NETFISH in 10 languages on relevant topics of fish quality management and sustainable fishing can be distributed among fisher folk during the training programme. Mere distribution of leaflets will not serve our purpose, one leaflet can be distributed in one training programme and the trainer can talk and explain in detail about the contents of that particular leaflet.

## 2. Audio-Visual Media

**Radio**

Radio can be a very effective fishery extension method when used together with

to the radio.

While radio can arouse listener interest in a certain subject, the advice of a trusted person is necessary for its effectiveness. A good extension message becomes more effective when a trusted person explains the details to the clients and answers all questions that arise.

NETFISH State Coordinators can identify local specific problems like wild seed collection, night trawling, etc to prepare a talk by eminent personalities like Scientist, Professors, etc, to telecast through radio either as question answer programmes or as mere talk.

**Television**

A well designed television programme can improve the learning effectiveness as the extension message can be demonstrated well in this method. The programme should be short, educational as well as entertainer. It should be broadcasted on a regular basis over a certain time period.

NETFISH State Coordinators can telecast the street-play programmes through television.


**Documentaries & Animations**

These tools are very effective in propagating the extension messages. The advantage is that audience can see what they hear. The message reaches their mind more clearly and they will not forget it easily. The documentaries and animations should be short, simple, well designed, educational as well as entertaining.

The four documentary films and two animation films made by NETFISH can be shown and explain to the fisher folk.

**Street plays**

Extension messages can easily be included in street plays to arouse people's interest and awareness which would help to improve their situation and their immediate environment. The street plays can be interesting and effective if it is performed in simple languages and by incorporating local art forms to it.

NETFISH Street-plays in each and every maritime states of India received immense acclaim from fisher folk, media as well as various extension agencies.

other appropriate extension methods. Valuable messages or events of special interest to the fisher folk can be propogated among the fisherfolk. For eg: 'Question and Answer' programmes on various fisheries and fisheries-related topics, as a forum to communicate local problems and solutions. It should be broadcasted at times when the fishermen and their families listen

CHAPTER 5

# CO-MANAGEMENT - AN EFFECTIVE SYSTEM TO MANAGE FISHERY RESOURCES

Fishery management systems evolved over centuries in response to increasing population pressures and the need to resolve disputes over access and exploitation of fishery resources. With modernization of fishery, a shift from traditional management mechanisms to government-driven scientific/economic management of the resources took place. Unfortunately, government-managed models of management also proved unsuccessful and it has become increasingly apparent that management initiatives will not be effective if the resource users (communities and fishers) are not fully involved in the management process. Therefore focus has been shifted towards co-management.

Fisheries co-management is a partnership approach in which the government, external agents (NGOs, academic and research institutions), the fishery resource users and other resource stakeholders share the responsibility and authority for the management of a fishery or fisheries in an area, based on collaboration between themselves and with other stakeholders. It covers various partnership arrangements and degrees of power sharing and integration of local (informal, traditional, customary) and centralized government systems. Partnerships are pursued, strengthened and redefined at different times in the management process, depending on the existing policy and legal environment, the political support of government for community-based initiatives, and the capacities of community organizations to become partners. The amount of responsibility and/or authority that the government and fishermen have will differ, and depend upon location specific conditions.

## Nature and advantages of Co- management system

1. It is a transparent, autonomous and a smooth management process
2. More economical and requires less to be spent on administration and enforcement.
3. Provide an effective platform for sharing knowledge/information among partners (members)
4. Most appropriate localized solutions to local problems are possible through management strategies and regulatory measures adopted in Co management.
5. Fishermen's indigenous knowledge and expertise are highly used to provide information on the resource base and to complement scientific information for management.
6. Create a greater sense of ownership over the resource which can provide a powerful incentive to conserve and protect the resources rather than to over exploit
7. True and voluntary involvement in the

formulation and implementation of management and regulatory measures resulting in a higher degree of acceptability and compliance

8. Effective and swift implementation of management decisions is possible Increased communication and understanding among the partners which can minimize conflict.

9. Provide an opportunity to improve stewardship, management decision-making, and communication between government and fishermen

The success of a co-management system depends on the following strategies.

1. Demonstrate and communicate the benefits and importance of co-management, promote the scaling up of pilot/demonstration activities at different levels of government.

2. Provide an appropriate national policy and legislative frameworks to enable effective co-management of both small- and large-scale fisheries.

3. Ensure legitimate representation of, and trust among, stakeholders.

4. Strengthen human and institutional capacity of all relevant stakeholders to enable co-management.

5. Empower fishing communities to engage in co-management arrangements.

6. Establish, enhance and increase linkages and communication between stakeholders.

7. Focus research and learning on fisheries co-management. 8) Make available and support sustainable financial arrangements for fisheries co management

Under co-management, resource users will get the benefit of participating in management decisions that affect their welfare and governments will benefit by being more effective and efficient, and potentially damaging conflicts, poverty and resource degradation can be avoided, or at least mitigated.

## Implementation

Implementing community-based co-management is always context-specific. For example, one community may have an existing and well-functioning fisher organization while another need sassistance in organizing. Another community may have a specifically defined set of objectives while another needs to develop a plan and strategy. During the 'beginnings' or pre implementation phase, a preliminary plan and strategy is prepared to guide the implementation phase in the community. The goals and objectives identified in the preliminary implementation plan and strategy will be reflected in the types of implementation activities which will be undertaken and in the timeline for implementation. However, it is important to be flexible and adaptive as needs, issues and opportunities will change.

**The general types of implementation activities include:**

- Community entry and integration
- Research and participatory research
- Environmental education and capacity development
- Community organizing
- Comanagement plan and strategy
- Conflict management
- Comanagement plan implementation, including evaluation

### 1. Community entry and integration

Community entry and integration is normally led by the external agent essentially can be a NETFISH Coordinator. Community entry and integration establishes the initial working relationship between the community and the external agent and/or government involved with the programme.

Community entry and integration includes the following activities:

- Formally introducing the programme to the community
- Answering questions about the programme
- Establishing relationship with the community
- Participating in community life
- Identifying roles of programme partners
- Core group formation
- Organizing and attending meetings, training and awareness programmes

**Role of different stake holders of a Co management council:**

| Stakeholder | Role |
|---|---|
| Resource users/community | • Attending meetings and briefings |
| | • Prepare work plan |
| Local government | • Participate in meetings and discussions |
| | • Assist in organizing community meetings |
| | • Assist in identification of community boundaries |
| | • Assist preparation of work plans |
| Other stakeholders | • Attend meetings and briefings |
| | • Provide support |
| Community organizer | • Organize calls to government leaders |
| | • Orient to situation |
| | • Organize community meetings |
| | • Observation |
| | • Identify stakeholders |
| | • Prepare work plan |

## 2. The Community Organizer

The community organizer (CO) can be either from NETFISH or from NGO. The CO may come from within or outside the community. The CO is a facilitator (a person who enables organization to work more effectively) for the co-management programme. The CO will continue to work with the community until the CO and the community feel that external assistance on a daily basis is no longer needed for sustainability of the programme. The CO should facilitate rather than impose.

In a number of cases, there may be no CO to facilitate the co-management programme. There may only be a willing government fishery officer or college teacher to facilitate the programme. Co-management can still move forward. Most important, the individual will need to be open-minded, creative and respectful. The fishery officer or teacher can initially serve to mobilize and energize the co-management programme. This individual will need to learn new skills, such as community organizing and participatory research, in order to support the co-management programme. This can be achieved by seeking out assistance and information from NETISH or projects functioning in the area or country. The development of a network with other individuals or organizations working on the same issues can help in the learning process. The external agent and CO will play a central role in facilitating the co-management programme due to their knowledge and experience in community organizing, participatory methods, mobilization, education and information dissemination, and planning. The external agent and CO should have a phase-out strategy from the start of their involvement with the programme as the goal of their effort is to empower the community to manage the co-management programme and their resources themselves. The community should not become dependent upon the external agent to lead the co-management programme. As stated earlier, the role of the external agent should be to facilitate the co-management programme. The external agent and CO may need to continue to visit the community and provide assistance as needed after the phase-out

**The CO should have the following skills**

- Open-minded
- Creative
- Respectful
- Sensitive to local culture and gender
- Sense of humour
- Modest and humble
- Puts people at ease and does not set himself or herself apart or act superior
- Facilitate and guide rather than lead the process
- A clear understanding of the different theories of development
- Familiarity with the concept and process of community organizing and participation processes
- Social and community relationship skills such as skills in establishing rapport, conflict
- management and group maintenance
- A clear grasp of community-based co-management concept and process
- The ability to work with teams of professionals involved in the management of marine and coastal resource

- A clear perspective of when to phase-out and to 'let go
- Interviewing and documentation skills
- Ability to facilitate group meetings and discussions
- Communication skills

Before entering the community, the CO should become familiar with the area, including its history, resources, culture, economy, social structure, problems, needs and opportunities. This information may be obtained from secondary data sources such as reports and publications and from key informant interviews with those knowledgeable about the area such as local elected officials, other NGO staff that may have worked in the area and government agency staff.

**In conducting community entry, the CO should.**

- Know the audience;
- Know the background of the community and its leaders;
- Initiate informal discussion with local government officials;
- Become acquainted with leaders and key informants;
- Know the potential topics they might want to discuss;
- Prepare appropriate techniques (for example, interviews and visualization techniques);
- Prepare secondary materials as background information.

**3. Integration**

In order to be effective, the CO will need to integrate himself or herself in community life in order to have knowledge about community members; their culture, livelihoods, institutions, social structure and environment; and their needs, behaviour and problems. This is a critical time for the CO as he or she must be accepted by the community. There must be credibility, trust and respect between the CO, the community members and government. This will involve long days and nights of listening, observing, talking and involvement in community activities. It will involve explaining the co-management programme and adapting to local conditions. The CO must become accustomed to local culture and traditions. This can take several months. In order to gain this mutual trust and respect, the CO should observe, participate and hold informal conversations with a wide range of community members (Box 6.7). The CO should become a part of the community and participate in local economic and social activities. This may involve going to the fish landing site and talking to fishers, asking fishers to go fishing, talking to fish buyers and sellers in the market, attending local meetings, meeting women as they washcloths, singing karaoke. It involves being available and observant. Observations are qualitative descriptions of what is seen and heard and are obtained by attentively watching and recording the surroundings. Observations provide insight into activities that are difficult for people to describe and provide information on relevant activities, stakeholders and material culture. Directed observation looks at a specific activity, such as fish landing, or tries to answer a specific question, such as, 'How are cooperative meetings conducted?' Continuous observation seeks a broader understanding of activities and takes note of all regular activities throughout the day and night. Pay attention to everything and use all senses to observe. Introduce yourself and explain what you are doing. Ask questions concerning things relevant to the parameters being investigated, particularly activities which are not recognized. Take notes and take photographs (if possible).

Fully record the activities taking place. Sketch as many things as possible. If possible, play an active role in the activity. Be aware that observation can sometimes be intrusive and may involve time from local people. Interacting closely with particular stakeholders can affect their activity and interactions with other stakeholders, particularly when there are conflicts between and within groups.

**4. Courtesy call**

The CO should make courtesy calls to elected and traditional leaders. Elected leadersinclude those at state, municipal and village government levels, Traditional leaders include village chiefs, village elders, religious leaders and senior fishers. The purpose of the courtesy call is for the CO to

- Introduce himself or herself;
- Introduce the programme and its objectives;
- Introduce the concept of co-management;
- Introduce the approach to be taken to community participation and activities
- Determine the role of elected and traditional leaders and government
- Open communication and dialogue
- Determine the level of support
- Encourage participation and cooperation
- Determine the needs of the leaders (government and traditional)

This should not be a onetime visit but the start of a long-term relationship. Depending upon their interest, the leaders should be actively consulted and brought into the comanagement programme. There may be a need for frequent visits to inform and discuss programme activities and needs. It is important to note if the leaders are male-dominated; it is the role of the CO to consciously seek out and consult women members of the community, even if they do not play formal leadership roles. At this early stage, the CO may also make courtesy calls on government offices and staff for the same reasons as the leaders. This may include, for example, provincial/state and municipal fisheries office, environment and natural resource office, economic development office, agriculture office and local government office. The significant role of government and traditional leaders in co-management should be recognized. If any leaders show lack of or limited support, consider having someone from the community or someone who is known or respected by the leader and is supportive of the project visit with the leader and introduce co-management and the programme. Consider consulting with other leaders or government officials who could provide alternative channels to gain cooperation of the non-supportive leaders.

**5. Community meetings**

In a similar fashion as the courtesy calls on government and traditional leaders, the CO needs to inform the community about the programme. Community meetings are one method of doing this. The community meetings should have the same general purposes as the courtesy calls.

**6. Research and participatory approach**

The next major activity in the co-management process is research. The role of research in co-management is to help establish baselines, inform the management process, and nourish community education and involvement. A common mistake is to

focus on research to the exclusion of education and action. By involving community members in these activities, the research process itself becomes one of education and action. In this way, such participatory research lays the foundation of awareness and commitment from which other activities grow.

**7. Community organizing**

The active participation of people in a community in the co-management programme is at the heart of co-management. Success of co-management is directly related to a well-organized community that has been empowered to take action to manage and conserve its aquatic resources. Community organizing is much more than just establishing organizations, it is a process of empowerment, building awareness, promoting new values and behaviours, establishing self-reliance, building relationships, developing organizations and leadership, and enabling communities to take action (Table 9.1). Thus, as mentioned above, environmental education, capacity development and social communication are central elements of the comanagement process. Community organizing looks at collective solutions. It changes the balance of power and creates new power bases. It is a value-based process by which people are brought together in organizations to jointly act in the interest of their 'communities' and the common good. It has been reported that the fundamental source of cohesion of every strong community organization is the conviction that it offers its members a unique vehicle for exercising and developing their capacities as citizens. The empowerment process at the heart of community organizing promotes participation of people, organizations and communities towards the goals of increased individual and community control, political efficacy, improved quality of community life and social justice (Wallerstein, 1992). To participate in co-management, the stakeholders will need to organize themselves and arrive at an internal consensus on the interests and concerns that they want brought forward. Meetings and discussions are held among the individual stakeholders to identify and clarify their interests and concerns and for those individuals with common interests and concerns to organize themselves into groups. Effective community participation in co-management requires a strong community organization(s) to represent its members. In some cases, community organizations capable of representing their members in co-management already exist in the community. In other cases, organizations will either need to be strengthened or newly established. One or more community organizations may be needed in the community depending upon its size, diversity and needs. Appropriate person(s) from the organization must be selected to represent them in the larger co-management organization.

**8. Co management plan and agreement**

The co-management plan includes explicit identification of management strategies and actions,as well as co-management roles and responsibilities among the partners. The co-management plan should be structured around the key components of capability building, resource management, community and economic development, livelihood development and institutional development. The co-management plan should reflect the community's vision for the future. Initially, the plan may be focused on a specific issue or problem, such as reducing illegal fishing; but in better prepared communities or in more mature stages of the programme, the co-management plan may cover several issues or problems in a more integrated manner. In developing the

goal, objectives and activities, transparency is important if the management system is to be a learning one. This is particularly important for a process with uncertain outcomes. Therefore, documentation of process, plan, and outputs of and inputs to the process are necessary for the system to work. Transparency is also important if stakeholders are to be properly informed so they can participate fully. For some stakeholders, the process must go further, educating them to prepare for participation.

**9. Co-management plan implementation**

Once the plans and agreements have been approved the implementation should be started as soon as possible in order to capitalize on the good will and excitement generated by the negotiations. Implementation comprises the activities by which the co-management plan is carried out. The implementation process will involve numerous decision-making points and a different process from the one used to create the plan and agreements. All the activities in the co-management plan must be implemented correctly and in a timely manner if goal and objectives are to be achieved.

It is common to feel overwhelmed by implementation. There is so much to do and so much to coordinate. Implementation will require trusting the plan and trusting the partners and staff. No plan is perfect. There will be successes and failures. This is why continual monitoring and learning-by-doing has been emphasized. There may be failures early on as everyone learns to work together and do their job, by learning from it and moving forward.

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