Training Resource Material

Coastal and Marine Biodiversity and Protected Area Management

Module 5

Sustainable fisheries management

For MPA Managers

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

of the Federal Republic of Germany

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For MPA Managers

Summary

This module provides the much needed information on basics of fisheries management, and principles and practices of sustainable fisheries management in and around marine protected areas. Apart from providing useful case studies on the subject, this module also covers challenges and trade-offs associated with protection-oriented coastal management, synergies with MPAs and livelihood security.

Imprint

Training Resource Material:
Coastal and Marine Biodiversity and Protected Area Management
for MPA Managers

Module 1: An Introduction to Coastal and Marine Biodiversity
Module 2: Coastal and marine Ecosystem Services and their Value
Module 3: From Landscape to seascape
Module 4: Assessment and monitoring of coastal and marine biodiversity and relevant issues
Module 5: Sustainable Fisheries Management
Module 6: Marine and Coastal Protected Areas
Module 7: Governance, law and policies for managing coastal and marine ecosystems, biodiversity and protected areas
Module 8: Coasts, climate change, natural disasters and coastal livelihoods
Module 9: Tools for mainstreaming: impact assessment and spatial planning
Module 10: Change Management and connectedness to nature
Module 11: Communicating Coastal and Marine Biodiversity Conservation issues
Module 12: Effective management Planning of coastal and marine protected areas

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Indo-German Biodiversity Programme
A-2/18, Safdarjung Enclave
New Delhi 110029, India
T +91-11-4949 5353
E biodiv.india@giz.de
W http://www.indo-germanbiodiversity.com

Wildlife Institute of India (WII)
P.O. Box 18, Chandrabani
Dehradun 248001
Uttarakhand, India
T +91-135-2640 910
E dwii@wii.gov.in
W www.wii.gov.in

Indira Gandhi National Forest Academy (IGNFA)
Post Office New Forest,
Dehradun - 248006
Uttarakhand, India
Phone +91-135-2757316
Fax +91-135-2757314
E-Mail : director@ignfa.gov.in

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With guidance of:
Dr. Amita Prasad, Additional Secretary, Ministry of Environment, Forest and Climate Change (MoEFCC) Government of India
Dr. J. R. Bhatt, Advisor, Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India
Dr. Konrad Uebelhör, Director, Indo-German Biodiversity Programme, GIZ India
Dr. V. B. Mathur, Director, Wildlife Institute of India
Dr. Shashi Kumar, Director, Indira Gandhi National Forest Academy, India
Dr. J. Michael Vakily, Team Leader, CMPA Project, Indo-German Biodiversity Programme, GIZ India

Compiled and edited by:
Dr. Neeraj Khera, Senior Advisor, Indo-German Biodiversity Programme, GIZ India
Dr. K. Sivakumar, Scientist F, Wildlife Institute of India

Text and editing contributions from:
Dr. Sarang Kulkarni, Marine Biologist, Indian Institute of Scuba Diving and Aquatic Sports (IISDA), Dr. J.A. Johnson, Scientist D, Wildlife Institute of India; Dr. Ramesh Chinnasamy, Scientist C, Wildlife Institute of India; Dr. D. Adhavan, Project Associate, Wildlife Institute of India; Dr. Pradeep Mehta, Research and Programme Manager, Earthwatch Institute India; Mr. Luke Mendes, Writer, Filmmaker and Media Trainer, Mumbai; Mr. S. Gopikrishna Warrier, Regional Environment Manager, PANOS South Asia; Mr. Darryl D'Monte, Chairperson, Forum of Environmental Journalists of India (FEJI); Dr. Dirk Asendorpf, Journalist and Media Trainer, Germany; Ms Atiya Anis, Communications Expert, Indo-German Biodiversity Programme, GIZ India; Mr. Sanjay Dave, Charkha and Mr. Bharat Patel, MASS Gujarat [case studies of turtle rescue and community plantation of mangroves]; Dr. R. Ramesh and team, NCSCM [ecosystem services, differences between terrestrial and coastal ecosystems, GIS]; Ms Helina Jolly [economic valuation methods and examples]; Dr. S. Senthil Kumar, IGNFA.

Photos by:
Dr. Neeraj Khera, unless otherwise credited

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Key messages

- India is the second largest producer of fish in the world, its contribution to the global fish production being 5.43 per cent. Fish have been recognized a source of cheap protein, and fisheries are a source of foreign exchange.
- An ecosystem approach addresses both human and ecological well-being and merges two paradigms: protecting and conserving ecosystem structure and functioning; and fisheries management that focuses on providing food, income and livelihoods for humans. The main challenges facing the development of marine fisheries in the country include development of sustainable technologies for capture fisheries, yield optimization, infrastructure for harvest and post-harvest operations, landing and berthing facilities for fishing vessels and uniform registration of fishing vessels.
- Artisanal fishing (or small-scale fisheries) uses small inshore vessels and/or fixed gear (e.g., coastal traps, gill nets and cast nets). Artisanal fishers catch fish and other organisms for their own consumption and sale
- Commercial fishing is the activity of catching fish and other seafood for commercial profit, mostly from the wild. It provides a large quantity of food to many countries around the world, but those who practice it as an industry must often pursue fish far into the ocean under adverse conditions. Large-scale commercial fishing is also known as industrial fishing.
- Under an ecosystem approach to fisheries, the usual concern of fisheries managers – the sustainability of targeted species – is extended to address the sustainability of ecosystems upon which the fisheries depend, including people and fish stocks.

5.1 Status of the marine fisheries in India[1]

Distributed along the 8129 km coastline of the Indian Sub continent are 3,288 fishing villages with a population of 3.9 million fishers of which 0.9 million are active fishers. India today has 2.02 x 106 sq. km sea area, comprising 0.86 x 106 sq.km on the west coast (including the Lakshadweep Sea), 0.56 x 106 sq. km on the east coast and 0.60 x. 106 sq. km around the Andaman and Nicobar Islands.

1 Source: CMFRI, 2014 & 2015

The west coast of India is by far the most important area so far as fisheries production is concerned, accounting for over 70 percent of the national production.

The state of Gujarat, in the northwest, has for some years been the major fish producer in India. In 2001, Gujarat accounted for around 37 percent of the production of the west coast and 26 percent of the national production. Gujarat is closely followed by Kerala, in the southwest, which in 2001 contributed around 30 percent of the national production. The other west coast states of Maharashtra and Karnataka, along with the offshore islands, contribute the remaining 33 percent of the production of the west coast.

The Saurashtra coast, in the northwest, experiences winter cooling of oceanic waters during November-February with no significant upwelling, and consequently the fisheries in this area are dominated by demersal species (57.2 percent of landings) such as sciaenids, f atfish and ribbonfish.

The fisheries of the west coast of India can be conveniently divided into artisanal and industrial sectors or into inshore (<50 meters) and offshore fisheries. Artisanal fisheries dominate the inshore areas while industrial fishing dominates the offshore area, usually operating under the provisions of the Deep Sea Fishing Policy.

Managing fisheries in accordance with sustainability guidelines is not required by legislation either at the state or national/union level. As a result, many stocks both in the inshore and offshore areas are either fully exploited or overexploited although it is generally agreed that offshore areas are more lightly exploited and may, for some species, be underexploited.

Offshore species that are considered to have the greatest potential for increased exploitation rates are various species of tuna, threadfin bream, carangids and deepwater shrimp (Vivekanandan, 2002).

Marine pollution and coastal degradation have impacted the resources of the coastal areas (including estuaries) and have degraded the marine resource potential and marine biodiversity of these areas. As a result, the issues of overexploitation of many coastal fisheries resources have been becoming more important, even in areas where the number of fishermen and vessels have remained stable. However, within the context of marine and coastal ecosystem destruction in the Indian Ocean area, overexploitation of fisheries resources and coastal habitat destruction are not as much a problem in India as they are in other countries of the region.

The Indian marine fisheries have witnessed a phenomenal growth during the last six decades. The annual landings during the early 50's was estimated as 0.5 million tonnes annually which increased in the subsequent decades and f uctuated between to 2.3 to 3.3 million tones during the period 1990-2010 and reached an all time peak of 3.9 million t by 2012.

The reason for this increase in production is almost exclusively an increase in fishing effort, both in inshore areas and offshore. For example, in Gujarat, the fishing f eet had to increased in 2002 to 29,506 vessels, of which 19,092 were mechanized.

Methods of exploitation of marine fisheries resources vary from simple traps to large trawlers and from handlines to modern purseseiners.

There are also regional variation in fishing vessels and gear. Traditional catamarans, common on the east coast are not used on the west coast to any great extent, with dugout canoes being the more common traditional fishing craft.

Mechanized vessels include stern and outrigger trawlers, gillnetters, purseseiners, longliners and dolnetters (bag nets, mainly for Bombay duck) whereas traditional nonmechanized craft use handlines, gillnets and fish traps. There is a program in place to upgrade dugout canoes in the area by the addition of small outboard motors and, since 1977, 50 922 motors have been fitted to these traditional craft (Vivekanandan, 2002)

Salient features of Indian marine fisheries sector:[2]

- Gross value of Indian Marine Fisheries is estimated as US$ 2.8 billion
- The Export Value is US$ 1.6 billion
- Contributes to 3% total exports
- Domestic markets- 81% fresh; 5% frozen, 6% dry; 5% fish meal
- Per capita fish consumption is 2.58 kg (range 39 – 0.3)
- Share in GDP is 1% ; Share in agricultural GDP is 4%
- 1 million active fishers
- There are 1511 fish landing centers in the country apart from the 26 major fishing harbours and 38 nos of minor fishing harbours

The fishery, which in 2001 landed 2288,000 tonnes from the west coast, is a mixed artisanal/ industrial fishery and utilizes dugout canoes (Kerala coast), outrigger vessels (Maharashtra and Karnataka coasts) and purse seiners (offshore areas) to take the fish.

Most of the catch is locally consumed as fresh product although canning, freezing, drying and production of sardine oil are also undertaken. The fishery f uctuates significantly from year to year in response to oceanic conditions and particularly the abundance of phytoplankton blooms (*Fragillaria oceanica*, *Coscinodiscus* spp. and *Pleurosigma* spp.).

2 Source: CMFRI, 2015

Some facts on marine fishers, crafts and gears[3]:

- An increase of around one lakh fishermen families was noticed in 2010 as compared to 2005.
- Around 6.4 lakh fisher families do not possess any kind of craft, 5.21 lakhs were without any fishing gear and around 5.0 lakhs had neither. These are increments to the tune of 13%, 12% and 11% over the respective fishermen census 2005 figures.
- The number of fisher families wherein only women were involved in fishing and allied activities was 41,000 which was a 17% increase over corresponding 2005 figures. However, the percentage of such families to the total fishermen families remained the same at 5%.
- There are about 864,550 marine fishermen households in the country; 91.3% were traditional fishermen families.
- Nearly 61% of the marine fishermen families in the country (523,691) were Below Poverty Line (BPL).
- About 57.8% of the fisherfolk were educated with different levels of education.
- Among the fishers nearly 15.0% of the males and 13.9% of the females had primary level of education.

3 Source: CMFRI, 2014
http://www.cmfri.org.in/uploads/files/CMFRI2014_UN_Report.pdf

5.2 What is fisheries management?

5.2.1 Overview

Historically, fishing has been a major source of food for humanity and a provider of employment for much of the coastal population. As fishes have been considered as renewable natural resources, the tendency of harvesting these resources has been intensified in recent days.

As a results, over-exploitation of important fish stocks, modifications of ecosystems, significant economic losses and international conf icts about the management of fisheries have threatened the long-term sustainability of fisheries. At the same time, with increased knowledge and the dynamic development of various fishing technologies, it was realized that living aquatic resources, although renewable, are not infinite and need to be properly managed. Then the concept of fisheries management emerged.

According to the Food and Agricultural Organization (FAO), the definition of fisheries management is:

> *The integrated process of data gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives - FAO, 1997.*

5.2.2 Conventional fisheries management

Conventional fisheries managements is the approach in which stakeholders are those directly or indirectly involved in fishing activities and the entire fisheries is managed by government fishery authorities. They generally operate through regulations and penalties for non-compliance. This approach is targeted at single species or economically important resources and focused on the fisheries industry. It pays less attention to small scale fisheries.

5.3 Concept of stock and maximum sustainable yield (MSY)

5.3.1 Stock

The term ‘stock’ is very commonly used with reference to the exploitation of aquatic resources, specifically fisheries management.

A stock is a sub-set of one species having the same growth and mortality parameters and inhabiting a particular geographic area (FAO, 1991).

As long as there is no difference in growth and mortality, it is preferable to make stock assessments over the entire area of distribution of a species. In general, the growth and mortality parameters differ significantly in various parts of the distribution of a species. Stock assessments should be carried out for each stock of a species. The growth parameters are numerical values using which we can predict the body size of a fish when it reaches a certain age. The mortality parameters ref ect the rate at which the animals die, i.e., the number of deaths per unit time (death may be natural or by fishing). The essential characteristic of a stock is that its growth and mortality parameters remain constant throughout its area of distribution (FAO, 1991).

Stock: A group of individuals in a species occupying a well defined spatial range independent of other stocks of the same species. Random dispersal and directed migrations due to seasonal or reproductive activity can occur. Such a group can be regarded as an entity for management or assessment purposes. Some species form a single stock (e.g. southern bluefin tuna) while others are composed of several stocks (e.g. albacore tuna in the Pacific Ocean comprises separate Northern and Southern stocks). The impact of fishing on a species cannot be fully determined without knowledge of this stock structure.

5.3.2 Population dynamics

Population dynamics describes the growth and decline of a given fishery stock over time, as controlled by birth, death and migration. It is the basis for understanding changing fishery patterns and issues such as habitat destruction, predation and optimal harvesting rates. The population dynamics of fishes has been traditionally used by fisheries scientists to determine sustainable yields (Zabel et al., 2003).

The basic accounting relation for population dynamics is the BIDE model (birth, immigration, death and emigration model, Caswell, 2001):

$N_1 = N_0 + B - D + I - E,$

where N_1 is the number of individuals at time 1,
N_0 is the number of individuals at time 0,
B is the number of individuals born,
D is the number that died,
I is the number that immigrated and
E is the number that emigrated between time 0 and time 1.

While immigration and emigration can be present in wild fisheries, they are usually not measured. Care is needed when applying population dynamics to real world fisheries. Many aspects of population dynamics such as the size, age and reproductive status of the fish have been ignored in many stock assessments in the past. Similarly, other factors such as targeted single species catches, by-catches and physical damage to the ecosystem may accelerate stock collapses (Walter and Maguire, 1996).

The basic purpose of fish stock assessment is to provide advice on the optimum exploitation of fishery resources. Fishery resources are limited but renewable, and fish stock assessment is described as the search for the exploitation level that in the long run gives the maximum yield in weight from the fishery.

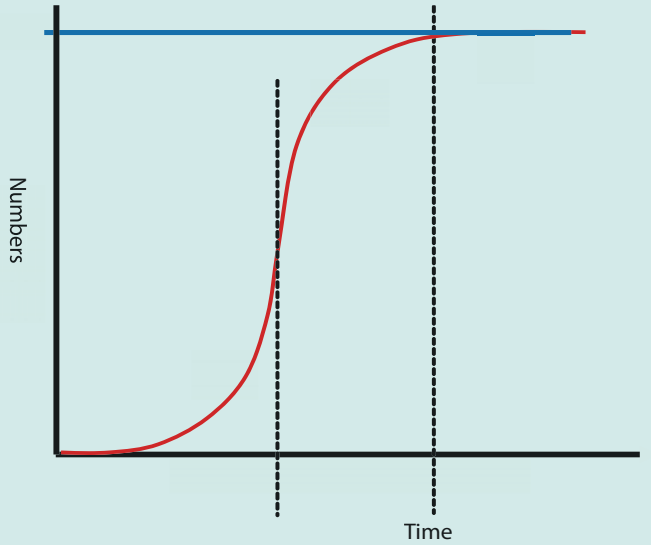
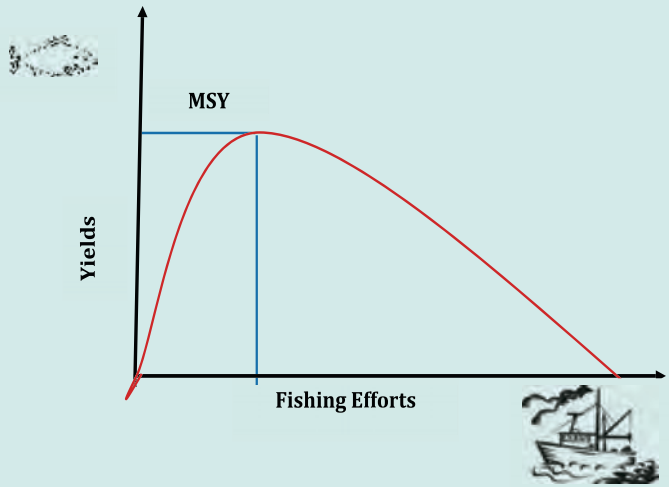


Figure 5.1 :The population growth at different time intervals [time 1 – slow growth stage (log phase); time 2 – growth acceleration phase (optimum sustainable yield); time 3 – carrying capacity of the population

5.3.3 Maximum Sustainable Yield (MSY)



Figrue 5.2 : Relationship of fishing effort and yield *(Source: FAO, 1991)*

Watch this video to learn more on MSY:

https://www.youtube.com/watch?v=7DNhqtYf47E

An Introduction to Fisheries Management

https://www.youtube.com/watch?v=Z4AXnZOsrK8

[Source : Conservation Strategy Fund, check out: http://www.conservation-strategy.org/]

In the figure 5.2, the horizontal axis is the fishing effort measure, for example the number of fishing days. On the other axis is the yield, i.e., the length and weight of the target species. The graph shows that up to a certain level we gain by increasing the fishing effort, but after that level the renewal of the resource (the reproduction and the body growth) cannot keep pace with the removal caused by fishing, and a further increase in the exploitation level leads to a reduction in the yield (FAO 1991).

In fisheries management, the maximum sustainable yield, or MSY is, theoretically, the highest catch that can be taken from a fishery stock over an indefinite period (Europa, 2006). Under the assumption of logistic growth, the MSY will be exactly at half the carrying capacity of a species, as this is the stage at which the population growth is highest. The maximum sustainable yield is usually higher than the optimum sustainable yield. Any small population initially has slow growth. At the some point the growth accelerates, and it levels off once the population approaches the carrying capacity. The idea of maximum sustained yield is to decrease population density to the point of highest growth rate possible.

5.3.4 Application

The harvest rate can be assessed and predicted on the basis of the MSY. The species recruitment rate, especially the addition of young ones, can be predicted. The harvest rate can be set at the point where the population growth rate is highest (the exponential phase). Fixed fishing quotas will produce a constant harvesting rate (a constant number of individuals fished in a given period of time).

5.4 Challenges and trade-offs of protection oriented coastal management

Major challenges in fisheries worldwide is uncontrolled harvesting of targeted species– even if catch quota systems are imposed they need to be monitored.

- Unrealistic and inf exible quotas
- Insufficient data on fish population characteristics and poor understanding of species ecology
- Intensive fishing, improved fishing technology and fishing industry

5.4.1 Overfishing

The worldwide depletion of major fish stocks through intensive industrial fishing is thought to have profoundly altered the trophic structure of marine ecosystems. Trophic levels in catches of fisheries have declined, with fish catches progressively being replaced by invertebrates and fishes that are not commercially important.

> *Overfishing is a form of overexploitation where fish stocks are reduced to below acceptable levels. Overfishing can occur in water bodies of any size, and can result in resource depletion, reduced biological growth rates and low biomass levels (http://en.wikipedia.org).*

Over-fishing has significantly affected many fisheries around the world. As much as 85 percent of the world's fisheries may be over-exploited, depleted, fully exploited or in recovery from exploitation. Significant over-fishing was observed in pre-industrial times. In particular, the over-fishing of the western Atlantic Ocean from the earliest days of European colonisation of the Americas has been well documented. Following World War Two, industrial fishing rapidly expanded with rapid increases in worldwide fishing catches. However, many fisheries have either collapsed or degraded to a point where increased catches are no longer possible (Bolster 2012).

Overfishing: Case study

The Peruvian coastal Anchovy fisheries crashed in the 1970s after overfishing largely depleted anchovies from its waters. Anchovies were a major natural resource in Peru. Indeed, 1971 alone yielded 10.2 million metric tons of anchovies. However, the following five years saw the Peruvian f eet's catch amount to only about 4 million tons. This was a major loss to Peru's economy.

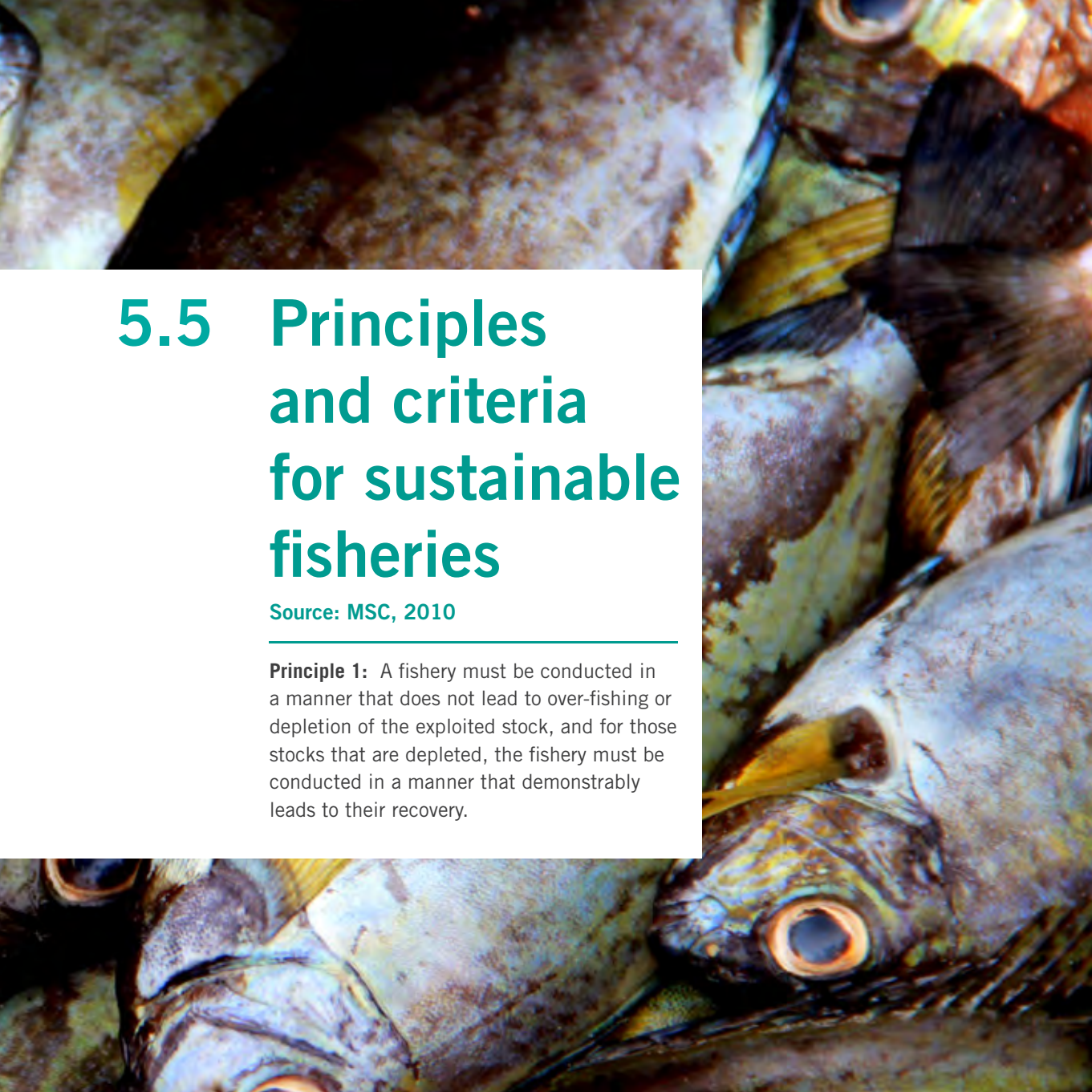
[W. G. Clark, "The lessons of the Peruvian anchoveta fishery," California Cooperative Oceanic Fisheries Investigations Reports, No. 19, 57-63 (1977). Available from http://calcofi.org/publications/calcofireports/v19/Vol_19_Clark.pdf]

5.4.2 Artisanal fishing (small-scale) Vs industrial fisheries (large-scale)

Artisanal fishing (often called small-scale fisheries) uses small inshore vessels and/or fixed gear (e.g., coastal traps, gill nets and cast nets). Artisanal fishers catch fish and other organisms for their own consumption and sale (Pauly 2013).

Commercial fishing is the activity of catching fish and other seafood for commercial profit, mostly from wild fisheries. It provides a large quantity of food to many countries around the world, but those who practice it as an industry must often pursue fish far into the ocean under adverse conditions. Large-scale commercial fishing is also known as industrial fishing. Commercial fishermen harvest a wide variety of animals, ranging from tuna, cod and salmon to shrimp, krill, lobster, clams, squid and crab in various fisheries for those species (http://en.wikipedia.org).

	Artisanal fishing	Commercial fishing
1.	Uses small boats without any facility for fish processing	Large sized vessels with facility for fish processing
2.	Uses fixed gears	Uses large sized commercial trawl nets
3.	Net with bigger mesh size for targeting adult individuals	Net with small mesh size for targeting all species (small and large body sizes)
4.	Minimum by-catch and trash fish landing	Huge landing of trash fish, which is used by for animal husbandry industries
5.	Operates in coastal area and shallow seas	Operates in EEZ and also deep water
6.	No negative impact on fish stock and ecosystem	Over-exploitation of stock and degradation of habitat quality



5.5 Principles and criteria for sustainable fisheries

Source: MSC, 2010

Principle 1: A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited stock, and for those stocks that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.

Criteria

1. The fishery shall be conducted at catch levels that continually maintain the productivity of the target population(s) and associated ecological community at a high level relative to the potential productivity.
2. Where the exploited populations are depleted, the fishery will be carried out such that recovery and rebuilding to a specified level are allowed consistent with the precautionary approach and the ability of the populations to produce long-term yields within a specified time frame.
3. Fishing is conducted in a manner that does not alter the age or genetic structure or sex composition to a degree that impairs reproductive capacity.

Principle 2: Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.

Criteria

1. The fishery shall be conducted in a way that maintains natural functional relationships among species and should not lead to trophic cascades or ecosystem state changes.
2. The fishery is conducted in a manner that does not threaten biological diversity at the genetic, species or population level and avoids or minimizes mortality of, or injuries to, endangered, threatened or protected species.
3. Where exploited populations are depleted, the fishery will be executed such that recovery and rebuilding are allowed to occur to a specified level within specified time frames, consistent with the precautionary approach and considering the ability of the population to produce long-term potential yields.

Principle 3: The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

Criteria

1. The fishery shall not be conducted under a controversial unilateral exemption to an international agreement.

2. The management system shall demonstrate clear long-term objectives consistent with MSC principles and criteria and contain a consultative process that is transparent and involves all interested and affected parties so as to consider all relevant information, including local knowledge. The impact of fishery management decisions on all those who depend on the fishery for their livelihoods, including, but not confined to, subsistence, artisanal and fishing-dependent communities, shall be addressed as part of this process.
3. The management system shall be appropriate to the cultural context, scale and intensity of the fishery – reflecting specific objectives, incorporating operational criteria, containing procedures for implementation and a process for monitoring and evaluating performance and acting on findings.
4. The management system shall observe the legal and customary rights and long-term interests of people dependent on fishing for their food and livelihood, in a manner consistent with ecological sustainability.

5.6 Good practices and case studies

5.6.1 An ecosystem approach to fisheries (EAF)

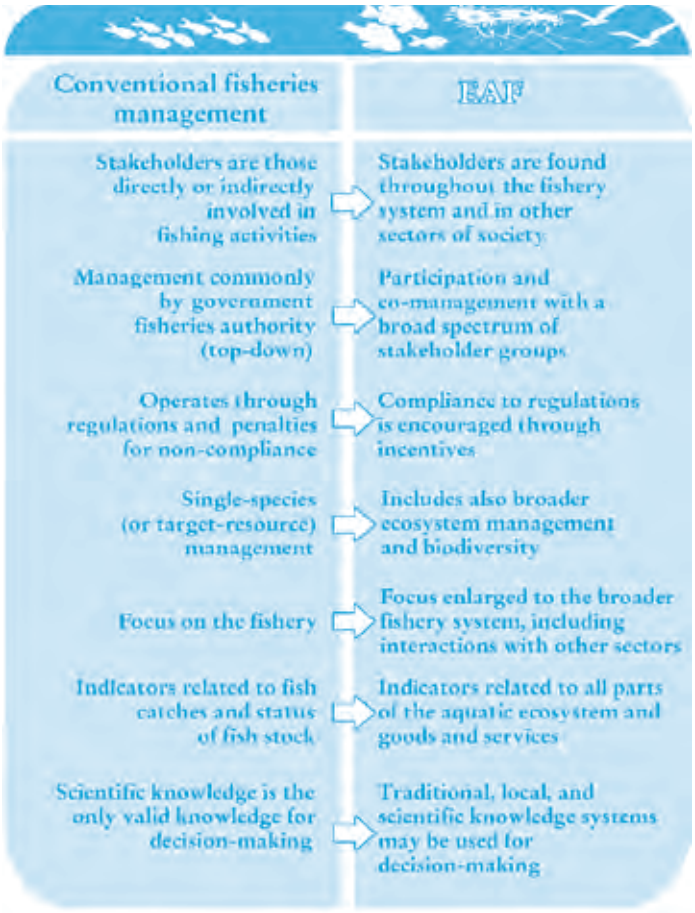
An ecosystem can be defined as a relatively self-contained system that contains plants, animals (including humans), micro-organisms and non-living components of the environment that interact with each other. Managing a resource species or fish stock in isolation from its ecosystem ignores the fact that fish species depend on ecosystems that are being affected by the fishing activity itself and by other human activities. Fishing can affect other components of the ecosystem by catching unwanted species, causing physical damage to habitats, disrupting food chains and causing changes in biodiversity.

Photo by: Dr. Sarang Kulkarni

Other human activities unrelated to fishing, such as agriculture, forestry and development, can also affect marine ecosystems, including the species that are part of them. The human impacts on ecosystems are often being exacerbated by the effects of climate change. Hence fisheries management with a broader approach attempts to manage fish stocks as components of marine ecosystems. Under an ecosystem approach to fisheries, the usual concern of fisheries managers – the sustainability of targeted species – is extended to address the sustainability of ecosystems upon which the fisheries depend, including people and fish stocks. Ecosystem approach address both human and ecological well-being and merge two paradigms: protecting and conserving ecosystem structure and functioning; and fisheries management that focuses on providing food, income and livelihoods for humans.

As the objective of ecosystem approach to fisheries is the sustainable use of entire ecosystems as well as targeted species, it is implied that non-fisheries activities that impact marine ecosystems must also be managed, even though such management activities may be outside the responsibilities of fisheries authorities. In addition to fishing, target stocks are affected by non-fishing issues including climate change, coastal development, pollution and the loss of critical habitats on account of reclamation. Because of the broad issues involved, the full implementation of ecosystem approaches to fisheries requires collaboration and cooperation between communities and a range of government agencies responsible for managing activities that have impacts on marine ecosystems.

Moving towards EAF - examples of the shifting focus[4]



4 Source: FAO 2011

5.6.2 Community-based fisheries management (CBFM)

Community-based fisheries management refers to a management system under which communities take a leading role in managing fisheries and adjacent coastal areas in partnership with, or with support from, a promoting agency.

Example of CBFM

The Peruvian coastal anchovy fisheries crashed in the 1970s after over-fishing largely depleted anchovies from the waters of Peru. Anchovies were a major natural resource 'in the country. Indeed, in 1971 alone the fisheries yielded 10.2 million metric tons of anchovies. However, the following five years saw the Peruvian f eet's catch amount to only about 4 million metric tons. This was a major loss to Peru's economy.

Source: Pauly 2013

5.6.3 USE OF VARIOUS FISHERIES MANAGEMENT TOOLS IN INDIA

Fisheries management is undertaken mainly through licensing, prohibitions on certain fishing gear, regulations regarding mesh size and establishment of closed seasons and areas. Under the Marine Fishing Regulation Acts (MFRA), zones are demarcated by each state on the basis of the distance from the shoreline (from 5 to 10 kilometres) or depth. These inshore zones, where trawling and other forms of mechanized fishing are not permitted, are perhaps the most important spatial fisheries management measure in place. The closed season or 'monsoon fishing ban' is another important spatial-temporal management measure. It is implemented along both the east and west coasts of India for a period of 47 days and 65 days, respectively, during what is considered to be the spawning and breeding season.

Several state-specific management measures exist. In Orissa, for example, fishing regulations have been adopted by the state fisheries department, under the MFRA, to restrict and regulate fishing activities in territorial waters. Regulations also protect the nesting and breeding grounds of turtles, both within and outside the Gahirmatha (Marine) Wildlife Sanctuary, through designation of 'no-fishing' and 'no-trawling' areas. There is also a mandatory requirement under the MFRA in some states that trawlers use turtle excluder devices (TEDs). It is important to draw attention to certain fisheries management initiatives of local fishing communities that are 'space-based'. Communities living along the coast often have a spatial perception of their 'rights', in exercise of which fishing by outsiders or the use of certain gear is regulated. Traditional fishing communities on the shores of Pulicat Lake, Tamil Nadu, practise a rotational system of access to resources, called the *padu* system, that serves to reduce conf icts and the pressure on resources. In coastal areas of Kerala, a similar system of rotational access to resources is practised that defines the group of rights holders, resource boundaries and fishing sites. However, these systems of self-governance are not legally recognized for management purposes in India.

Source : Sanders et. al. 2011

5.6.4 GLOBAL FISHING WATCH

Hundreds of millions of people depend on the ocean for their livelihoods and many more rely on the ocean for food. However, the world's oceans are threatened by global overfishing, illegal fishing and habitat destruction. Their sustainability depends on action by governments, fishery management organizations, citizens and the fishing industry itself.

Global Fishing Watch analyzes data from the Automatic Identification System (AIS), which is collected by satellites and terrestrial receivers, to identify apparent fishing behavior based on the movement of vessels over time. This public beta version of Global Fishing Watch is available to anyone with an Internet connection and allows users to monitor when and where commercial fishing is occurring around the world.

Citizens can see for themselves how their fisheries are being effectively managed and hold leaders accountable for long-term sustainability. Seafood suppliers can monitor the vessels they buy fish from. Journalists and the public can act as watchdogs to improve the sustainable management of global fisheries. Responsible fishermen can show they are adhering to the law. Researchers can address important fishery management questions.

Website: http://www.globalfishingwatch.org/

Youtube video: https://www.youtube.com/watch?v=fn2JXmCUo30

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Further resources

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