Management Tools

for the Ecosystem Approach to Fisheries Management (EAFM)

SEAFDEC 2021

Contents

These management tools were developed as part of a revision of the Essential Ecosystem Approach to Fisheries Management (E-EAFM) training course for the Southeast Asia Fisheries Development Centre (SEAFDEC) in 2019/20. The revision was funded by the USAID Regional Development Mission for Asia (RDMA) implemented by the National Oceanic and Atmospheric Administration (NOAA) and administered by the National Marine Sanctuary Foundation (NMSF). The management tools were further improved through a regional workshop conducted by SEAFDEC in August 2021, with the support of the Japan Trust Fund.

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Introduction

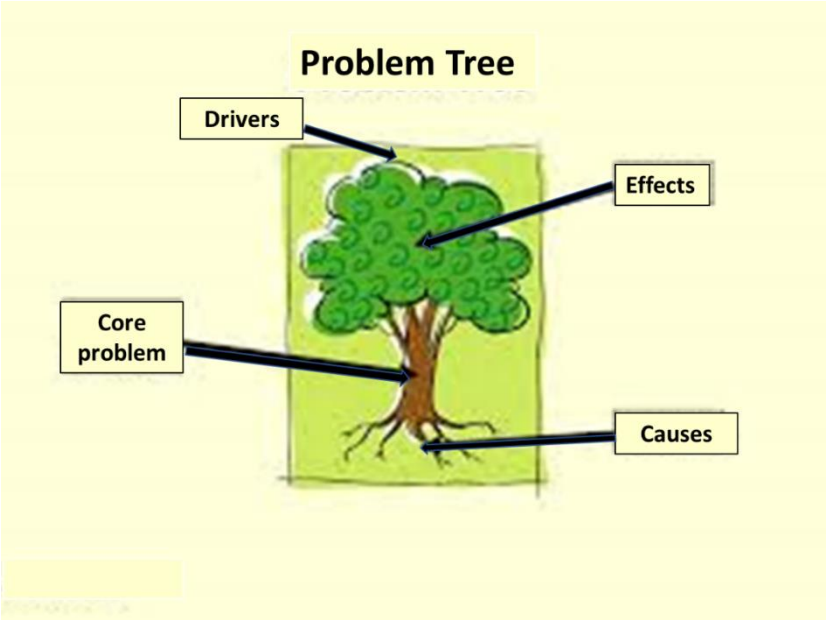
The ecosystem approach to fisheries management (EAFM) requires the broadening of conventional fisheries management to cover the ecological, human and governance dimensions of sustainable development. This broadening, in turn, also requires a broadening of the scope and number of relevant fishery management tools needed to implement EAFM. In this booklet, we introduce and summarize a range of tools that focus on managing fishing activities under EAFM, including tools to manage broader environmental issues, as well as achieving social, economic and governance objectives. These are presented as fact sheets for each management tool.

Management tool framework

A problem tree approach has been used to organize the tools into a logical framework. Whenever we consider the threats and issues for a given fishery, a wide variation of issues becomes apparent - some are very broad (e.g. pollution) and some are very specific (e.g. bombing reefs). They will also often be a mix of causes and effects relating to the fisheries resources, the ecosystem and the socio-economic performance.

A problem tree recognizes four levels of issues that help sort out the different types of issues and their causes and effects:

1. ***Driver***: the large-scale events that have a flow-on effect on many issues, e.g. growth in population and wealth, or climate change.
2. ***Effect:*** the effect that the core problem creates (both environmental and socio-economic);
3. ***Core problem:*** the actual problem; and
4. ***Cause:*** the causes of the problem. These can be broken down further into main and underlying causes.



The problem tree can easily be converted into a solution tree that helps identify threats and issues at a level that can be addressed by management (i.e. tools that address the causes, not the symptoms of the problem and its effects).

1. ***Effect:*** identifies the goals of management
2. ***Core problem:*** identifies the objective of a management intervention
3. ***Cause:*** identifies what management tool to use

In developing the management tools in this booklet, we firstly identified a number of core problems and effects that are common in the fisheries of Southeast Asia. In the table below, issues relating to ecological well-being are shown in green, governance in red and human well-being in blue. These were derived from the problem trees shown at the beginning of each section below.

Effect: Declining catch and value		
Problem 1: Overfishing	Problem 2: Excess catch of spawners and juveniles	Problem 3: Loss of critical habitat
Effect: Loss of biodiversity		
Problem 1: Loss of habitat and natural resources	Problem 2: Impacts of fishing on ecosystems	Problem 3: Killing of endangered, threatened & protected species
Effect: Illegal, unreported and unregulated (IUU) fishing		
Problem1: Excess fishing capacity	Problem 2: Weak compliance	Problem 3: Weak governance arrangements
Effect: Inadequate fisheries management		
Problem 1: Inadequate fisheries data and information	Problem 2: Inadequate fisheries management capacity	
Effect: Low income, profits and rents		
Problem 1: Low prices of fish products	Problem 2: High operating costs	
Effect: Poverty and marginalization		
Problem 1: Lack or limited alternative livelihoods	Problem 2: lack of access to resources or sense of ownership	Problem 3: Conflict among sub-sectors

Each fact sheet also has a header that specifies what core problem(s) and cause(s) the tool can address. These are also summarized as matrices of tools that can address the different causes, shown at the beginning of each section.

Criteria for selecting the right tool

The tools selected in the matrices are neither directive nor conclusive. Users of this guidebook should take into account the context of the fishery they are considering and consult with stakeholders to decide which tools are most appropriate. A check list for selecting the most appropriate tool is given in the table below.

Purpose of the tool	
	What is the main objective of the tool?
	Does the tool directly address the cause of the problem?
Fishery characteristics	
	Is the fishery a small-scale artisanal or a large-scale commercial fishery?
	What type of fishing gear do they use?
	Are the markets easy to access and flexible in their demands?
Socio-economic conditions	
	Is the fishery operated by a small number of relatively rich entrepreneurs?
	Is the fishery made up largely by a large number of poor boat owners?
	Are the fishers living day-today through loans and deals with money lenders and middle people?
	Do fishers have other alternative livelihoods for income?
Governance	
	Is there political will to address the cause?
	Is there sufficient MCS in place to ensure compliance and enforcement?
	Is there sufficient data and information for the tool to work e.g. catch landings, fishing effort?
	Were the stakeholders part of the process to agree on management actions?
	Are there arrangements in place to carry out monitoring and evaluation of the management action?
Ease of implementation	
	Does the tool require or depend on other process and activities before it can implement? If yes, are those feasible?
Cost	
	Is there sufficient budget to implement and maintain the tool (e.g. staff costs, capital costs, operational cost)?
Timeline	
	Can the tool be implemented to address the issue and help solve the problem within the needed time?
Human capacity	
	Do the government staff or key partners have sufficient capacity to implement the tool?
	Do the stakeholders have sufficient capacity to adopt the tool?

Ecological well-being: Tools E1 to E19

Declining catch and value

Loss of biodiversity

E1. Total allowable catch (TACs)

Ecological well-being: Overfishing/ Loss of critical habitat
Governance: Excess fishing capacity
Human well-being: Low price of fish products/High operating costs

What it is

An output control management measure that sets the limit on the total catch that can be taken from the resource in a given period of time (usually one year). The TAC can also be divided among the operators in the fishery (see separate fact sheet on IQs and ITQs).

Purpose

To control fishing operations to a level commensurate with the productivity of the fisheries resources, normally in a large-scale industrial fishery (see Annex 1 for background on controlling fishing effort and catch) (FAO 2009).

How it works

The logic behind TACs is, that if there is enough knowledge about the biology of the stock and the past and present fishing pressure, scientists can establish how much of the fishery resources that can be extracted so as to meet a given management goal such as limiting catches to the maximum sustainable yield (MSY) (Squires et al. 2012).

The way in which this approach works is usually:

1. The fisheries scientists establish the status of the stock and establish the sustainable exploitation rate (e.g. MSY).
2. The TAC is then estimated so as to meet the management's long-term goal – often a precautionary percentage of the MSY.
3. The season is open until total landings meet the TAC.
4. The fishery is closed.

Advantages

TACs provide an access right to the fishers. This helps fishers conserve the resource as they have a share in the resource.

Disadvantages

Establishing and implementing a TAC is difficult, especially in a multi-species/multi-gear fishery. Difficulties include (i) there is the need for an independent scientific body with resources to evaluate the status of the fishery resource on which to base the TAC, and (ii) there is also a need for a real-time monitoring system and enforcement body that ensures the TAC is not surpassed.

Over and above these difficulties, TACs still generate perverse incentives for fishers to go and extract as much as possible before the fishery closes down. Thus, despite limiting the total catch, the management action can lead to an increase in the efficiency of fishing effort and a decrease in the fishing season length. To fix this, TACs are often allocated as individual quotas (IQs) or individual transferable quotas (ITQs) (see next fact sheet).

Examples of use

In general, TACs are currently not used without being linked to some form of quota system. Fisheries such as the Bering Sea crab fishery and the Alaskan Halibut fishery that operated under the TAC system in the past, faced many challenges. The TAC system resulted in an unlimited number of boats participating in the fishery that encouraged the so-called “race to fish” that was extremely dangerous. In some fisheries, such as sturgeon (caviar) fishing, TACs resulted in an extremely short and intensive fishing season that were very competitive.

E2. Individual quotas (IQs) and individual transferable quotas (ITQs)

Ecological well-being: Overfishing/ Loss of critical habitat
Governance: Excess fishing capacity
Human well-being: Low price of fish products/High operating costs

What they are

IQs are a method of management based on output catch controls whereby the TAC is allocated among eligible operators as shares in the TAC. ITQs are IQs that can be traded, in their entirety or partially, among the respective quota holders.

Purpose

To control fishing operations to a level commensurate with the productivity of the fisheries resources, normally in a large-scale industrial fishery (Shotton, 2001).

How it works

1. The fisheries scientists establish the status of the stock.
2. A TAC is then estimated so as to meet the management's long-term goal – often a precautionary percentage of the MSY.
3. Quotas are allocated to fishers/fishers' groups (normally as a percent of the TAC).
4. Fishing stops for a for each fisher/fisher groups when the catch of a given species or species group reaches the quota.

Advantages

Under an IQ or ITQ system, all participating fishers are assigned a portion of the TAC that they can extract whenever they want in the prescribed season. The main advantage behind this management approach relates to the fact that by having a secure share of the quota, there is no need to compete with other fishers before the season is over. In other words, IQs and ITQs imply assignment of property rights over an actual amount of catch and not just over the right to fish. (Squires et al. 2012).

Disadvantages

Establishing and implementing a TAC on which to base the IQs/ITQs is difficult, especially in a multi-species/multi-gear fishery. Difficulties include (i) there is the need for an independent scientific body with resources to evaluate the status of the stock on which to base the TAC, and (ii) there is also a need for a real-time monitoring system and enforcement body that ensures the quotas are not surpassed.

The initial application of quotas is always controversial – who get what shares depend on a number of criteria, but these are not always equitable. ITQ programs have been criticized for increasing the incentive for fishermen to provide false catch reports and to "high-grade" their catch (high grading is discarding smaller/lower value catch in favor of fish that fetch a better price).

In some cases, it is also possible for larger companies, processors or wholesalers to obtain effective monopoly control over the landings through consolidation. ITQs could discourage new entrants into a fishery because of the additional capital investment required to purchase or lease quota shares.

Examples of use

IQs and, more commonly ITQs, are used extensively in many fisheries around the world. They are used for both single species and multi-species fisheries, but mainly restricted to temperate waters where the number of species is more limited than in tropical fisheries. As of 2008, 148 major fisheries (generally, a single species in a single fishing ground) around the world had adopted some variant of this approach, along with approximately 100 smaller fisheries in individual countries.

Iceland, New Zealand and Australia embraced ITQ initiatives early in their development, and they are now starting to reap the rewards of these changes in management. In New Zealand most fisheries are managed under ITQs. The US, Europe, North and South America has been a little slower to progress to ITQs, although more and more ITQ systems are being introduced. Many countries only adopt ITQs for those fisheries where TACs can be calculated effectively, while other fisheries are managed using different tools (e.g. Australia).

E3. Total allowable effort (TAE)

Ecological well-being: Overfishing/ Loss of critical habitat
Governance: Excess fishing capacity
Human well-being: Low price of fish products/High operating costs

What it is

An input control measure that specifies the maximum level of fishing effort that can be applied to a fish stock during a specified period. TAEs are usually expressed in terms of the number of operating vessels in the management area and/or the number of fishing days. The effort capacity of each vessel can also often be controlled (e.g. gear unit limits, such as maximum headrope length for a trawl net, or maximum soak times for stationary gear). The TAE can also be divided among operators (see separate sheet on IEQs and IETQs).

Purpose

To control fishing operations to a level commensurate with the productivity of the fisheries resources.

How it works

1. The fisheries scientists establish the status of the fishery resource.
2. The TAE is then estimated so as to meet the management's long-term goal (e.g. a precautionary percentage of the fishing effort needed to catch the MSY).
3. The number of boats allowed to fish is controlled through licensing (and boat registration, and/or setting a limit to the number of fishing days for all boats, and/or setting the total number of fishing days.
4. Fishing stops when the fishing effort reaches the TAE.

Advantages

Effort rights-based management has clear advantages in the following cases:

- in complex multispecies fisheries in developing countries (especially with complex tropical multispecies ecosystems);
- in artisanal fisheries;
- where data for stock assessments and close monitoring of catches are largely unavailable or of low quality;
- where monitoring, control and surveillance (MCS) costs for catch systems are prohibitive; and
- where uncertainty about the absolute level of biomass occurs (also needed for a TAC management approach).

Disadvantages

Effort rights-based management creates incentives to maximize revenue and catch, and in the process creates incentives to increases fishing power through technological change, including vessel size, and more-efficient fishing practices (known as “effort creep”).

A TAE system without quotas can also lead to “race to fish” as fishers compete with each other to get a higher share of the TAE, especially if the TAE is a total fishing day limit.

Examples of use

TAEs are used to control fishing operations in most countries of the world that have moved from “open access” to “limited access”. This includes both developing and developed countries. In many countries, such as Australia and USA, both catch limits (TACs, ITQs) and effort limits (TAE and IEQs) are used in different fisheries based on their nature and ease of estimating an accurate TAC.

Most species in Japan have been managed through a total allowable effort (TAE) approach that limits seasons and gear. In the ASEAN region, Thailand and Malaysia are the best examples of countries that have successfully have imposed fishing effort limits, both in terms of boat number and fishing days (see Individual effort quotas (IEQs). In Thailand, this reform from an “open access” to a “limited access” fishery was initiated in 2015.

E4. Individual effort quotas (IEQs) and individual transferable effort quotas (ITEQs)

Ecological well-being: Overfishing/Loss of critical habitat
Governance: Excess fishing capacity
Human well-being: Low price of fish products/High operating costs

What they are

IEQs is tool where the TAE is allocated among eligible operators as shares in the TAE. IEQs limit the fishing effort that each fishing boat can apply to a fishery. This is usually a restriction on time away from port, or fishing days that the vessel can employ. Like individual catch quotas IEQs can be transferable (ITEQs).

Purpose

To control fishing operations to a level commensurate with the productivity of the fisheries resources, normally in a large-scale industrial fishery.

How it works

1. The fisheries scientists establish the status of the stock.
2. The TAE is then estimated so as to meet the management's long-term goal (e.g. the fish fishing effort need to catch a percentage of the MSY)
3. Quotas are allocated to fishers/fishers' groups.
4. Fishing stops when the catch of a fisher/fisher group reaches the quota.

Advantages

Effort quotas can create incentives for self-adjustment. Where IEQs are transferable, fishers can purchase them from existing fishers or sell to new entrants, which can allow the consolidation of fishing activity, reducing the level of excess capacity and possibly also the level of overcapacity.

Disadvantages

As with vessel catch limits, enforcement is difficult, especially when effort is expended away from port and restrictions can be evaded. As with gear and vessel restrictions, “effort creep” is a problem. While days fished or trawl time may remain constant, the fishing power of the vessel can be increased through technological improvements, including vessel size, and more-efficient fishing practices.

Examples of use

IEQs and, more commonly ITEQs, are used extensively in many fisheries around the world in both single species and multi-species fisheries, but mainly restricted to single species or simple small fisheries. Examples include Australia, Canada, Iceland, Netherlands, Thailand, United Kingdom. In general, effort quota systems are becoming replaced by catch quota management, as the management systems evolve.

Thailand has recently introduced an IEQ system where the commercial fishing vessels are allocated a limited number of fishing days for each year, based on the TAE.

E5. Territorial use rights in fisheries (TURFs)

Ecological well-being: Overfishing/ Loss of critical habitat
Governance: Excess fishing capacity
Human well-being: Low price of fish/High operating costs /Conflict among subsectors

What they are

Area-based fishing rights that allocate secure, exclusive access rights to fish in a specified area to groups, or in rare cases individuals. The groups (or individuals) can exclude others.

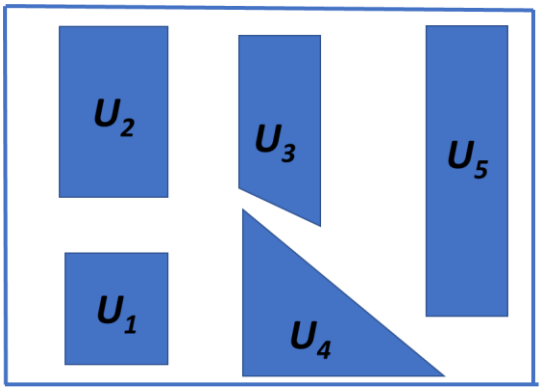
Purpose

To control fishing operations to a level commensurate with the productivity of the fisheries resources, normally in a small-scale artisanal fishery (Afflerbach, 2014).

How it works

The main idea behind assigning TURFs is to allocate exclusive access to individuals (or groups of individuals) to certain geographical areas where they can fish the species of interest.

Fishing grounds can be assigned for exclusive access or some other joint arrangements. The TURFs do not have to be homogenous.



Advantages

TURFs, when designed properly, provide fishers with enough incentives to harvest the resource to maximize benefits, rather than to outcompete other fishers. When mixed with designs

proposed by the users, individual TURF design can be greatly improved by the superior knowledge fishers have about the resource and its distribution.

Disadvantages

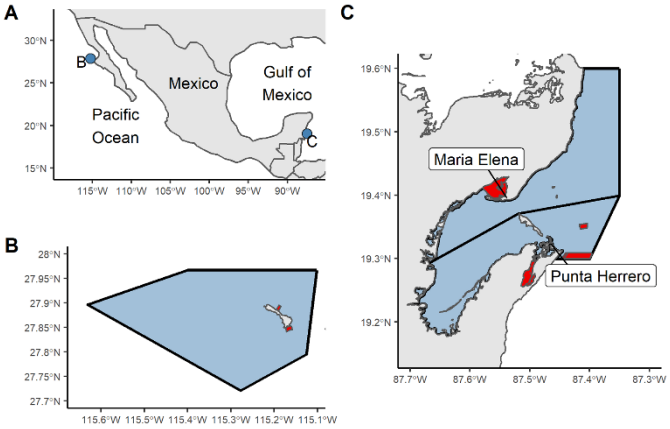
As with other management actions, there are difficulties in implementation. When delimiting a TURF, the fact that water and many of the organisms are constantly flowing in and out of that TURF needs to be taken into account. A TURF system will be more effective for species that have a high degree of site fidelity, or that do not move as much.

As with any other method of establishing property rights over a common pool resource, this tool results in winners and losers. The losers may not have exclusive access to the resource, or the area they are allocated may not be as productive as others. The problem is to find the best way to grant these rights such that the incentives align with the goal.

Examples of use

Fisheries management using a form of TURF has been practiced for centuries in many places of the world. Management in this pre-modern era was traditionally organized by local fishing communities and connected with religious beliefs, rituals, and customs. Asia-Pacific region was especially rich in such systems. Ruddle and Johannes (1985) described examples in 21 Asian Pacific countries where community-based management, often with de facto territorial fishing rights, were in place. Many also existed in the Caribbean, South America, Africa and the Middle East. Similar systems were used by aboriginal populations in North America, Australia and New Zealand. Several countries in Europe also had well-established fisheries TURFs in place. A well cited example is that of the North Norwegian fishery, which resulted in the enactment of a law in 1816 that established what has come to be known as territorial use rights.

However, such traditions have been replaced (with a few notable exceptions in Hawaii, the Gulf of Maine, some South Pacific islands, parts of Africa, and other places) with policies and laws that encouraged access for all (“open access” or “fisheries modernization”) and the extraction



of maximum sustainable yield based on the policy that fisheries resources should be managed by government.

E6. Vessel buybacks

Ecological well-being: Overfishing/ Loss of critical habitats/Impacts of fishing on the ecosystem
Governance: Excess fishing capacity
Human well-being: Low price of fish/High operating costs /Conflict among subsectors

What it is

The buying of a vessel and/or its right to fish by others to remove it from the fishery. The funding can come from private sources and/or government, or commonly a mixture of both. This tool is way of implementing TAEs.

Purpose

To control fishing operations to a level commensurate with the productivity of the fisheries resources, normally in a large-scale industrial fishery.

How it works

In simple terms, vessels are bought back, usually to the highest bidder. This can be done through a number of bidding programs including single price or reverse auctions, single or multiple rounds of bidding and sealed or open bidding.

Advantages

As with management tools that limit fishing effort and capacity, successful buyback can raise profits received by the remaining owners of vessels and licenses and economic rent to the fishery in the short run. Fewer vessels mean that rent is shared among these fewer vessels. Lesser fishing capacity can lead to greater catch rates for the remaining vessels, possibly allowing gains in economies of scale and scope for the remaining vessels and reduce overall industry costs (especially capital) and vessel costs. Buy-backs can contribute to decreasing the overall fishing capacity of a fleet.

Disadvantages

Buybacks in fisheries do not, by themselves, necessarily sustain profits to vessels and rents to the fisheries over the long run. Long-term rent gains depend on the ability to limit replacing, or even expanding, fishing capital. Buybacks in transboundary fisheries exploiting highly-migratory species face additional complexities.

There are several critical preconditions for a buyback of licenses or vessels. These include:

1. A proper registration of licenses and vessels needs to be in place to create a well-defined group of eligible owners and to provide well-defined boundaries to the fishery and the programme.
2. Measures are needed to prevent new vessels from entering the fishery in place of the ones that have been removed. Without a pre-existing programme of limited entry, ITQs or some form of common or private property or use rights that strengthen the exclusive-use characteristic of property rights, funds from purchased vessels or licenses can be used to purchase an upgraded or new vessel for the fishery, or new participants may enter the fishery as it becomes profitable.
3. Measures are needed to prevent vessels that have been bought back in one fishery, shifting to another fishery. Ideally, vessels that have been bought back need to be destroyed.

Examples of use

Buyback programmes for vessels and licenses have been widely applied in Europe, North America, Australia and Northeast and Southeast Asia. In Northeast Asia, they have been applied to the Japanese high-seas longline fishery and to the Taiwanese offshore longline and drift net fisheries. In Southeast Asia, Malaysia bought back vessels in the west coast Peninsular demersal (finfish and shrimp), pelagic and traditional inshore fisheries.

E7. Spatial closures and marine protected areas (MPAs)

Ecological well-being: Overfishing/ Excess catch of spawners and juveniles/ Loss of critical habitats/ Impacts of fishing on ecosystems/
Governance: Excess fishing capacity
Human well-being: Low price of fish/High operating costs /Conflict among subsectors

What they are

Spatial closures and MPAs are areas designated and effectively managed to protect marine ecosystems, processes, habitats, and species, which can contribute to the restoration and replenishment of resources for social, economic, and cultural enrichment.
Spatial fishing closures as a management tool for fisheries have a long history in fisheries and predate the current concept of MPAs. FAO defines MPAs as any marine geographical area that is afforded greater protection than the surrounding waters for biodiversity conservation or fisheries management purposes. In rest of this fact sheet we use this generic term MPA to cover both spatial closures and MPAs.

The MPA concept is applied diversely around the world, and with different names for similar policies. MPAs can range from small village-level community-managed areas to large, multi-uses zoned national parks. The specific rules associated with an MPA vary by context and names are not used consistently. A 'reserve' in one country may prohibit fishing, while a 'reserve' in another country may allow non-destructive fishing. Other terms used, to name a few, are fully protected marine areas, marine parks, marine sanctuaries, ocean sanctuaries, fishery closed areas, fisheries refugia (see separate fact sheet) and locally managed marine areas.

Purpose

MPAs generally have biodiversity conservation objectives and/or fisheries management objectives. Most MPAs are likely to have consequences for fisheries and fishery resources – even when established without explicit fisheries management objectives in mind. In the same way, it is probable that fisheries spatial management measures will have biodiversity conservation outcomes (FAO 2011).

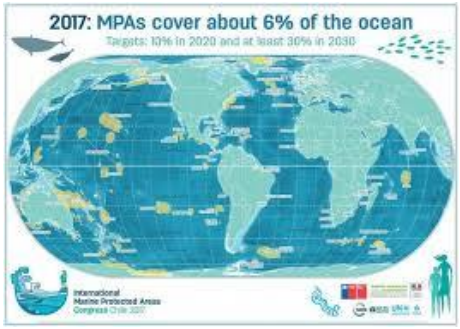
MPAs can be implemented to achieve:

- rebuilding fish stocks;

- ensuring sustainability of fish stocks and fisheries;
- protecting marine biodiversity and critical habitats;
- supporting local and traditional sustainable marine-based lifestyles and
- communities;
- increasing resilience to climate and other environmental changes;
- facilitating the resolution of multiple stakeholder conflicts;
- facilitating scientific research;
- recreation; and
- protecting cultural and archaeological sites.

How they work

MPAs work through limiting or, in some cases, excluding human activities in an area.



MPAs vary depending on the types of activities that are permitted within the boundaries of the protected area. These include:

- Multiple Use: allows extractive uses (like fishing) with some restrictions.
- No-Take: allows people to use the area but prohibit extraction or any destruction to the area. These are often called marine reserves.
- No Impact: allows people to use the area but extraction, disposal of possible pollutants, the installation of materials, and disruption to the environment of any kind is not permitted. These types of MPAs are rare but sometimes occur in research only zones.
- No Access: restricts all access to the area. Also, very rare and mainly used for research purposes.

MPAs can also vary in terms of how long the area will be protected, which will have a significant impact on their overall success:

- **Permanent:** protected indefinitely until future legislation ends the protection.
- **Conditional:** potential to continue into the future, but reviewed periodically to see if it is meeting its objectives.
- **Temporary:** designed to meet short-term conservation goals, including closing a fishery so that a particular species can recover.

Some examples of MPAs with a fisheries management objective include:

- Permanent “no-take” area to protect a critical habitat;
- Permanent “no-take” area to protect a certain life-history stage of a fish population (e.g. closure of a nursery area); and
- Closure of an area to certain types of fishing operations (e.g. zoning of inshore areas for the exclusive use of small-scale artisanal fishers).

MPAs can be linked in MPA networks so that a collection of individual MPAs or reserves operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels that are designed to meet objectives that a single reserve cannot achieve. MPA networks may also involve zoning, in which different areas can have different levels of protection (see Annex 4 on marine spatial planning (MSP)). Multiple MPAs in an area can be flexible with regard to which activities are allowed in which areas (no-take areas, fishing with certain types of gear, recreational fishing, etc.), while still having common fisheries management and biodiversity conservation objectives.

Advantages

If of sufficient size and managed and complied with effectively, there is considerable evidence that MPAs can protect habitats, increase biodiversity and have other possible fishery benefits including larger fish, higher densities and greater biomass. There are also indications of flow-on benefits occurring outside the protected area boundary through adult and larval movements. However, benefits over large areas or for entire fisheries are as yet unknown.

Disadvantages

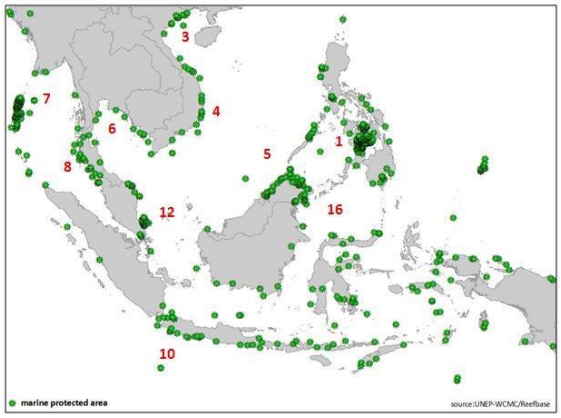
Effective MPAs always require some form of compliance and enforcement mechanisms. The most common cause of failure to meet the MPAs’ objective is a lack of consultation and agreement among stakeholders affected by the creation of MPAs. There are many examples where MPAs have been implemented without adequate consultation with the stakeholders that have failed.

The formation of MPAs also often involves the displacement of people from their traditional fishing grounds and can change the rights of access and use of fisheries resources of affected people, especially when they are imposed without adequate stakeholder participation. Conflict often stems from the marginalization of artisanal fisheries by other forms of resource utilization such as dive tourism.

Although MPAs are often claimed to reduce fishing effort, evidence for this claim is scarce. Fishers excluded from one area often increase fishing pressure in adjacent areas.

Examples of use

MPAs with biodiversity objectives and/or fisheries management objectives are common throughout the world, especially in coastal waters. In Southeast Asia, there is an increasing number of MPAs being created (see map). Fish refugia examples are shown in a separate fact sheet.



Zonation of the inshore area for the exclusive use of small-scale artisanal fishers is common throughout Southeast Asia as a tool to reduce conflict. However, in many countries this tool has not been that effective and encroachment of larger-scale fishing, such as trawling is common. Some countries are now using vessel monitoring systems (VMS) to help enforcement, but this is not available in all countries. Strategic placement of artificial reefs is also being used to more effectively protect small-scale artisanal fishing (see fact sheet E16).

E8. Fish refugia

Ecological well-being: Excess catch of spawners and juveniles/ Loss of critical habitats

Human well-being: Low price of fish/High operating costs

What they are

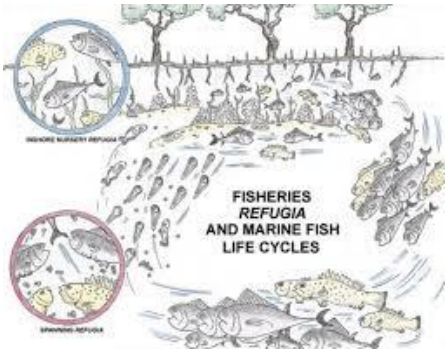
A spatially and geographically defined marine or coastal area that is designated to sustain fisheries resources and promote sustainable use during critical stages of their life cycle. They can be thought of a special kind of MPA that focus on management of fisheries resources.

Purpose

The main purpose of a fisheries refugia is to protect either the fisheries resources during critical stages in their life cycle (spawning and nursery grounds) or areas of habitat required for the maintenance of brood stock.

How they work

Fisheries refugia have the objective of sustainable use of the fisheries resources and provide for some areas within the refugia to be permanently closed (no-take area) due to their importance to the life cycle of a species or group of species or an area of critical habitat.



Advantages

Fisheries refugia are more easily understood and likely to be accepted by fisheries communities than either the science of no-take areas MPAs or the concept of biodiversity and its conservation. The approach aims to provide benefits in terms of the maintenance of critical fisheries habitats (and hence fisheries production) while at the same time minimizing the costs borne by fishing communities in terms of reductions in household income and food production.

Disadvantages

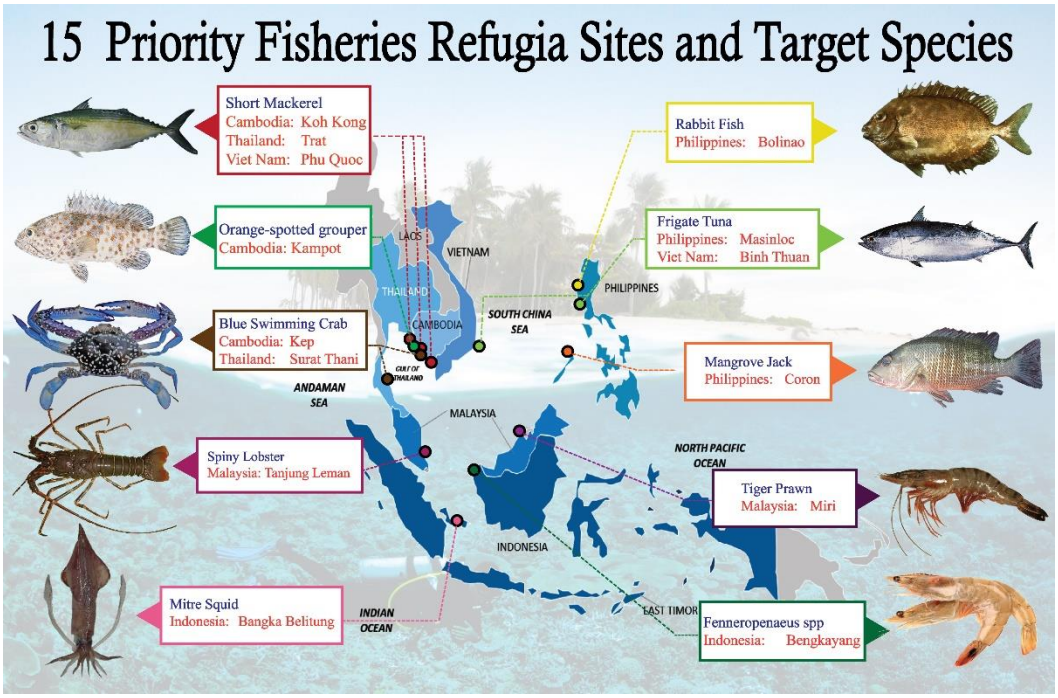
The main problem with fish refugia is similar to that of the broader MPAs in that they can exclude people that previously relied on the area for their livelihood and income, but are now excluded. In a fisheries context, this often means that the fishing effort is not reduced but simply displaced to areas that are outside the fisheries refugia.

Compliance and enforcement of the rules of an fisheries refugia (e.g. no fishing) is also difficult to achieve and can be expensive. This is especially serious when the original users of the area were not consulted in its formation.

Examples of use

The concept of fish refugia is unique to Southeast Asia. Other parts of the world use the term multiple-use MPAs where the objective is the sustainable use of natural ecosystems and no-take zones are restricted to certain areas. SEAFDEC advocates the use of the term fisheries refugia to distinguish them from no-take MPAs.

The SEAFDEC South China Sea Fisheries Refugia Network project has identified a number of refugia sites (see map).



E9. Temporal closures

Ecological well-being: Overfishing/ Excess catch of spawners and juveniles/ Impacts of fishing on ecosystems/Killing of ETPs
Governance: Excess fishing capacity
Human well-being: Low price of fish/High operating costs /Conflict among subsectors

What they are

Closing an area to fishing operations for a certain period, especially in places and times where fish aggregate and are vulnerable to fishing. Common temporal closures include seasonal closures to protect different life history stages (e.g. a seasonal closure when fish aggregate for spawning).

Purpose

Temporal closures can be used as a tool to reduce annual fishing effort, although this benefit is questionable (see disadvantages below). More commonly they are used to protect certain life-history stages such as young recruits or spawning fish. In some fisheries, seasonal closures are used to allow fish/shrimp time to grow larger and thus fetch a higher price and better returns.

How they work

If the purpose of the closure is to protect a certain stage in the fish's life history, the area and time of the closure is based on an analysis of fish biology and migration patterns.

If the purpose is to reduce overall fishing effort, a suitable time is chosen to ensure the greatest effect with the least impact. If the purpose is to increase the monetary returns from fishing, the closures are based on the size, abundance and price of fish/shrimp, often based on real-time surveys.

Advantages

From a biological perspective this approach can improve reproductive success and support recruitment. It is relatively simple to enforce, as any boat caught fishing is in violation of the rules. From an economic perspective, a seasonal closure may have short-term benefits to fishermen in terms of: (i) the reduction of operating costs; (ii) financial compensation arising from the recovery of stocks where fishing has ceased; and (iii) compensation subsidies (if the administration funds the closure).

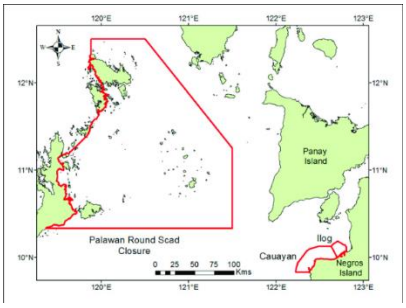
Disadvantages

The effectiveness of the tool for reducing fishing effort is questionable. Fishers often increase their fishing intensity in the period between closures and overall effort remains high. Ceasing fishing operations of the fleet for long periods (e.g. monthly closure) can result in serious logistical and economic problems, especially in fisheries where savings are low or non-existent.

Multi-species fisheries, where a large number of species are harvested, often have different spawning and recruitment times for the different species, and a blanket closure might be effective for some but not for others.

Examples of use

Because of the seasonal nature of spawning and recruitment, seasonal closures are a popular form of management in many shrimp fisheries. They can also be used to delay the start date of a season to allow the shrimp to grow to a size that fetches higher prices. Seasonal closures are also common in the management of small pelagic fish. Examples in the Philippines include the Sulu Sea, southern Mindanao sardine purse seine fishing, the Northeast Palawan fishing area and areas wests of Palawan for round scad, and the Visayan Sea for sardines.



In India a seasonal fishing ban comes into effect, every year, in coincidence with the monsoon season on each respective coast. On the East coast the ban starts mid-April and ends in mid-June. On the West coast, the ban starts from the beginning of June and finishes at the end of July. Seasonal closures to protect Indo Pacific mackerel and other economic species during their spawning season and juvenile stage are in place in Thailand.

E.10 Ecolabelling

Ecological well-being: Overfishing/Loss of habitats and natural resources
Governance: Weak compliance
Human well-being: Low price of fish/High operating costs /Conflict among subsectors

What it is

Ecolabels are seals of approval given to products that are deemed to have fewer impacts on the environment than functionally or competitively similar products (e.g. Marine Stewardship Council ecolabel).

Purpose

The goal of ecolabelling programmes is to create market-based incentives for better management of fisheries by creating consumer demand for seafood products from well-managed stocks (Wessells, 2001).

How they work

Independent assessors assess a given fishery for its management performance against a number of criteria. For the Marine Stewardship Council (MSC) the criteria are grouped into three core principles:

- *Principle 1: Sustainable target fish stocks*: A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.
- *Principle 2: Environmental impact of fishing:* 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.
- *Principle 3: Effective management:* 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.

If the fishery passes the assessment, it is given a seal of approval that distinguishes it in the market place. Environmentally concerned buyers are willing to a pay a little extra for a certified product.

Advantages

Ecolabelling has many potential societal benefits, including environmental improvement, accurate information dissemination to consumers, improved market share for producers, and increased awareness and interest by the public about environmental issues. As consumers grow increasingly aware of environmental issues and the role their purchases may play in environmental degradation, market shares of products with some form of ecolabelling may grow at the expense of products without labelling.

Disadvantages

Current assessments are aimed primarily at relatively simple single-species fisheries that lend themselves to single-species stock assessments and target species management controls. However, as the concept grows, criteria aimed at more multi-species/multi-gear fisheries are developing. Many of the schemes, to date stress the environmental performance with little consideration of social and economic performance.

Examples of use

Since the MSC was founded in 1997, fisheries responsible for over 15% of global wild marine catch have been certified to the MSC Fisheries Standard. Certification is helping to grow and maintain the number of sustainable fish populations. To remain certified, fisheries have made more than 1,600 improvements to their performance and management to date. Worldwide, more than 38,000 sites, including supermarket chains, restaurants, fishmongers and hotels are now certified to sell seafood with the blue MSC label.

In the past decades, only a few fisheries in ASEAN countries have been certified. Although the legal frameworks in ASEAN member states generally provide a fair basis for their fisheries to meet the requirement of the fisheries certification standards, further improvements are required to incorporate the concept of adaptive management, precautionary approaches, and reference points on fishery management objectives (Lieng 2018).

E11. Restocking and stock enhancement

Ecological well-being: Overfishing/Killing EPTs

What they are

Restocking refers to the production and release of fish into wild population(s) where the species historically occurred naturally but have been reduced.

Stock enhancement refers to the production and release of fish into wild population(s) where the species historically occurred naturally, for the purpose of augmenting the natural supply of fish to optimize harvest or increase catch rates.

Thus, releasing fish into existing populations to augment fishing is stock enhancement and releasing fish to restore depleted spawning biomass is restocking.

Purpose

To increase fish abundance, catch rates and/or fishery yields. The aim is to restore severely depleted spawning biomass to a level where it can once again provide regular yields or to restore self-sustaining populations in the wild.

How they work

Juvenile fish are either raised from brood stock in an aquaculture facility or caught from other places and are then released into the wild.

Advantages

Restocking and stock enhancement has occurred around the world for decades with varying degrees of success. Potential benefits from fish restocking or enhancement include:

- increasing the catch and catch rates of a species;
- improving fishing opportunities;

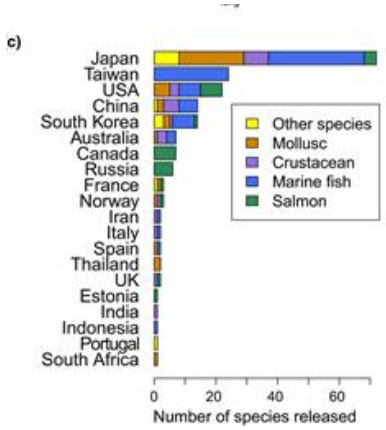
- restoring a depleted stock;
- restoration after catastrophic mortality events;
- compensating for nursery or breeding ground loss/degradation;
- shifting fishing effort from some species towards other species;
- ‘seeding’ a fishing enhancement structure (artificial reef); and
- conserving or reintroducing critically endangered species.

Disadvantages

Restocking and stock enhancement activities need clear objectives and need to be well planned and targeted at situations where there is a reasonable expectation of having a beneficial effect. Stock enhancement or restocking needs a scientific, evidence-based and stakeholder participatory approach within a sustainable fisheries management framework to maximize the likelihood of success. Risks, such as possible genetic implications of releases also need to be assessed.

Examples of use

A total of 187 species were released by 20 countries between 2011 and 2016. In the scale of operations, variety of species produced, amount of financial backing, and degree of popular and official support, the Japanese fisheries restocking program is unique. From its birth in 1962 when the government established two hatcheries on the Seto Inland Sea, it has undergone continuous expansion. Some 37 coastal prefectures have sea farming centers operating.



Twelve national centers have been opened and five more are under construction. There are also other semi-government or private hatcheries. In Southeast Asia, restocking is practiced more in inland waters but can occur in coastal waters in some countries, including Malaysia, Indonesia and Thailand.

E12. Banning of destructive gears and practices

Ecological well-being: Overfishing/ Excess catch of spawners and juveniles/Loss of critical habitat/Impacts of fishing on ecosystems/Killing ETPs
Governance: Excess fishing capacity
Human well-being: Conflict among subsectors

What they are

Destructive fishing practices are practices that easily result in irreversible damage to aquatic habitats and ecosystems. Many fishing techniques can be destructive if used inappropriately, but some practices are particularly likely to result in irreversible damage. These are normally banned through legislation and/or regulations.

Purpose

To reduce the impact of fishing on fisheries resources and their supporting environment (FAO; UNEP. 2010).

How they work

The FAO Code of Conduct for Responsible Fisheries (CRRF) specifically advocates the prohibition dynamiting, poisoning and other comparable destructive fishing practices. Different countries and Regional Fisheries Management Organizations (RFMOs) can specify what they consider as destructive fishing gears and practices. Examples include push netting, encircling nets and very long surface gill nets.

Advantages

Banning of destructive gears and practices, if successfully implemented and complied with, can have large benefits in terms of protecting and conserving fisheries resources, critical habitats, killing of ETPs and catching of juvenile fish.

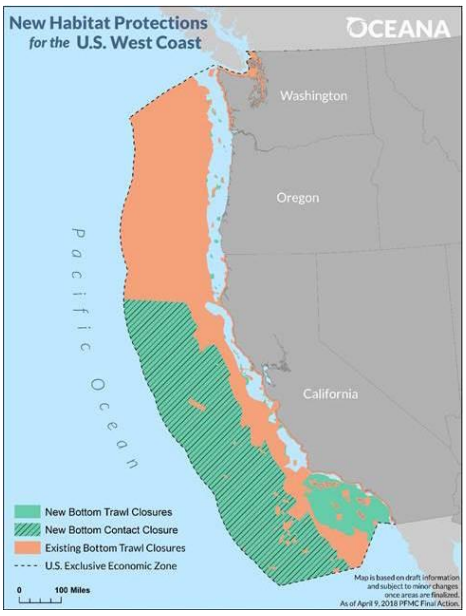
Disadvantages

The banning of destructive gears and practices needs to be supported by effective monitoring, control and surveillance (MCS) to be effective. Many gears and practices have been banned in developing countries over the past 50 years but some are still persisting in different parts of the world. Bottom-up MCS instigated by concerned fishing communities and fishers has proved to be an effective deterrent.

Examples of use

Dynamiting and poisoning of fish on coral reefs have been banned in most countries of the world. Countries including Australia, Brazil, Canada and Malaysia have established no-trawl zones in inshore waters to protect marine resources. Indonesia has implemented a trawling ban that extends across the entire country. Many countries have banned bottom trawling in large areas of seamounts and hydrothermal vents.

Other gears that are banned in some countries include push nets (for example Thailand), large-scale surface gillnets, encircling nets, tidal traps and dredges.



E13. Gear modifications

Ecological well-being: Overfishing/Excess catch of spawners and juveniles /Loss of critical habitats/Impacts of fishing on ecosystems/Killing ETPs
Human well-being: High operating costs

What they are

Technical changes to fishing gear to allow unwanted fish and other aquatic animals to escape. These include changing mesh sizes, adding bycatch reduction devices (BRDs), grids, panels in nets, and adding turtle exclusion devices (TEDs) and juvenile and trash exclusion devices (JTEDs) (Boopendranath and Pavin 2009).

Purpose

Gear modifications are largely aimed to reduce the catch of juvenile fish of both commercial and non-commercial species, to improve species selectivity, to reduce discards and minimize impacts on habitats. Modifying the gear can also result in lowering the effective fishing. Modified gear can also increase fuel efficiency and lower fishing costs.

How they work

Mesh size and modification to the net

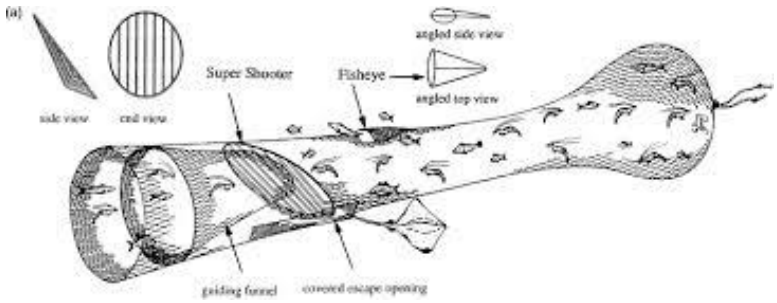
One of the most common gear modifications is to change the mesh size of the fishing net (both stationary gear such as gill nets and active gears such as trawls and seines). Increasing the mesh size results in a catch of larger-sized fish. Increasing the mesh size can also decrease the effective fishing effort a lower overall catch.

Other modifications to the net include square mesh and T90 mesh orientations (mesh is orientated 90 degrees to the body of the net, and together with a different knot and thicker twine,) can be used to create an escape panel in an existing diamond mesh codend. Square mesh or T90 can also be used to construct an entire codend.

Bycatch reduction devices

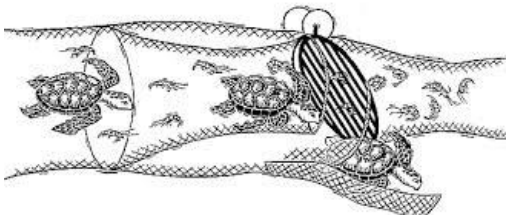
Devices developed to exclude/reduce catch unwanted catch (e.g. juvenile fish, endangered, protected and threatened (EFT) species), especially in trawling, are collectively known as Bycatch Reduction Devices (BRDs). Various types of BRDs have been developed in the fishing industry around the world. Most BRDs rely on one of two methods of excluding bycatch. The first is mechanical or physical exclusion, achieved by blocking the passage of bycatch into the codend and guiding it towards an escape opening (e.g. inclined grids or panels of netting to physically block the passage of bycatch into the codend and guide it toward an escape

opening.) The second method utilizes differences in behaviour between the bycatch and target species. Fishes for example, are capable of swimming in a moving net, orientating to the direction of tow and swimming through an escape opening. Shrimp on the other hand generally exhibit little directional swimming and are passively filtered into the codend. Examples of this type of BRD are the fisheye and square-mesh windows.



Turtle reduction devices (TEDs)

Turtle Excluder Devices are specific form of BRD, designed to protect sea turtles.



Juvenile and trash fish exclusion devises (JTEDs)

A JTED consists of three sections hinged together; the first two sections are metal grids and the third section is a metal frame supporting a panel of fine-mesh netting. Small fish swim between the bars of the grids and escape. The netting panel in the third section helps maintain the orientation of the device, prevents shrimp surging forward in the codend and escaping, and prevents small fish from re-entering the codend. The JTED was designed by SEAFDEC and has been tested in shrimp fisheries in several ASEAN countries.

Advantages

If gear modifications are developed in consultation with fishers and the fishing industry, there is considerable evidence that gear modifications can exclude small fish and bycatch, and, if designed specifically for certain ETPs, can exclude a large number of those EFTs. Gear modifications can also increase towing time (less drag and fewer hauls) and may reduce sorting times. Some gear modifications such as increased mesh size can reduce fishing pressure.

In general, this tool is relatively easy to ensure compliance, at least in terms of the physical definition of the modification(s). For example, mesh size rules and regulations can be checked

with port inspections. Other modifications such as TEDs are a bit more difficult as fishers can modify the device while at sea.

Disadvantages

Unless demonstrated conclusively to be otherwise, fishers are reluctant to adopt any gear modification if they perceive it will decrease their catch. If the modification is not accepted by the majority of fishers, they are unlikely to be implemented and used. Fishers will also find ways around the gear modification to suit their perceived needs. For example, increased mesh size in the codend can be countered by either towing the net at a different speed to pull the mesh tighter, or fitting smaller mesh further up in the net (as seen recently in pair trawls in Thailand).

Examples of use

Minimum mesh size is a very common tool used across the world and is legislated in many countries, including many Southeast Asian countries. For example, the minimum mesh size for trawl net codend in Thailand is 4.0 cm, 2.5 cm for purse seines and 0.6 cm for anchovy purse seines.

Trawl fisheries in different parts of the world are now being required to use BRDs and TEDS. Examples include escape panels (square mesh) that are mandatory for some areas in Europe and TEDs that are compulsory in many shrimp fisheries including Australia and the USA. The introduction of TEDs in shrimp trawls has dramatically reduced mortality of endangered sea turtles. The decline of the bycatch and discards of finfish in many shrimp trawl fisheries has mainly been the result of the sorting grids and square mesh panels introduced in these fisheries. Changes in the construction and operation of tuna purse seines have significantly reduced the mortality of dolphins that can be incidentally captured. Technical measures to reduce the incidental catch of seabirds in longline fisheries have also been successfully developed.

JTEDs have been tested in shrimp fisheries in several ASEAN countries, including Vietnam, Thailand, Malaysia, Myanmar, Philippines, Brunei Darussalam and Indonesia, but no adoption of the technology has occurred to date.

E14. Minimum or maximum legal size

Ecological well-being: Excess catch of spawners and juveniles

Human well-being: Low price of fish

What they are

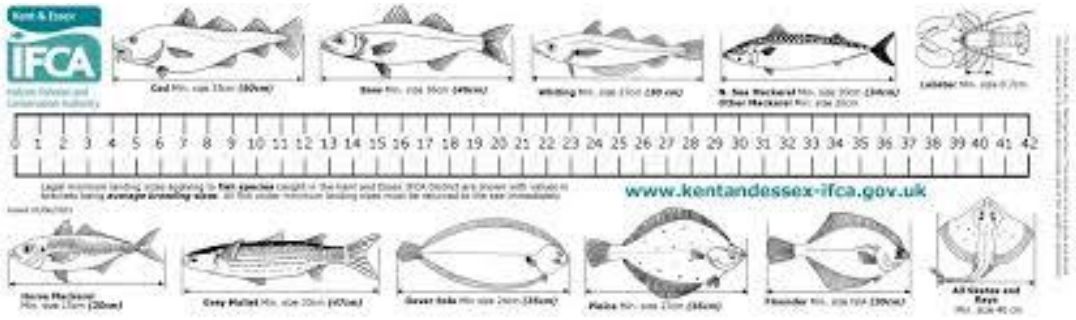
Minimum or maximum legal size of harvested fish is another technical tool that is commonly used to manage fisheries. Regulations normally specify that the capture or landing of a fish of a certain size is not permitted.

Purpose

The intent behind the minimum size is to prevent the harvesting of non-commercial, juvenile fish. The prohibition against large fish is usually intended to preserve mature stock of breeding age.

How they work

In theory, fish that are under or over the legal size are released back to water to survive until they either grow bigger, or spawn.



Advantages

Regulations that limit the size of fish landed are intuitive and can easily be appreciated by fishers. In some fisheries, where there is a limited number or target species, and where discarding practices are adequately monitored, legal size limits can be effective. They are often useful in recreational fisheries where the catch is small, and the fish can be safely released.

Disadvantages

The effectiveness of legal-size regulations is difficult to assess. Fish can be inspected when they are being offloaded in fishing ports or at a fish landing site, but there is no real way of knowing whether non-legal fish that were discarded survived or not. The extent to which released fish survive is also very variable and depends a lot on the method of capture. Fish caught in passive gears, such as traps can often be released live back into the water, but fish caught in active gears, such as trawls, are often damaged and may not survive.

In reality, legal-size regulations cannot be enforced without continual monitoring at sea. The surveillance costs to enforce these regulations are difficult to justify unless there is a physical presence on the vessel at all times, e.g. observer programme, or a high level of inspections at sea. Use of cameras at sea can be used to reduce costs.

Legal size limits are also very difficult to impose on a multispecies/multigear fishery. When hundreds of species are being caught. Setting limits for all, or even some, of these species is not really practical.

Examples of use

Because of the limitations described above, legal size limits are usually applied to fisheries where there is a small number of target species, or in recreational fisheries. The tool is not commonly used in more tropcal multispecies/multigear fisheries, although it is being introduced in the management of crab fisheries. For example, measures to control minimum catch size is occurring in several ASEAN countries as part of their Fishery Improvement Projects (FIPs).

E15. Restoration of habitats

Ecological well-being: Excess catch of spawners and juveniles/ Loss of critical habitats/ Impacts of fishing on ecosystems
Human well-being: Conflict among subsectors

What they are

Critical habitats, such as mangroves, seagrasses and coral reefs, can be restored through interventions such as planting or creating the right environment for habitats to grow back naturally.

Purpose

The purpose is to restore degraded critical habitats, both in structure and function, to a state before degradation occurred.

How they work

Correct planting and creating the right environment for habitats to grow back naturally to a healthier state that supports critical fisheries life-cycle stages and increase biodiversity.

Advantages

Habitat restoration has many advantages. One of the most important of these is in terms of public relations, especially when the public is involved in the restoration efforts by building awareness of the importance and value of healthy habitats. Restoration can also be carried out by local authorities and non-government organizations (NGOs)

Other benefits include:

- Providing critical habitat for fish;
- Increasing biodiversity;
- Preventing erosion;

- Mitigating against climate change; and
- Creating more space to accommodate competing uses.

Disadvantages

The IUCN advises that the majority of planting efforts are failing. Restoration is unsuccessful when mangroves, seagrasses and coral reefs are replanted without taking into consideration the environmental requirements for their successful growth. A more effective approach is to create the right conditions for plants and animals to grow back naturally. For example, mangroves restored in this way generally survive and function better. Coastal and shallow water habitats, like seagrass and coral reefs, can be prohibitively expensive to restore and restoration activities often have a high failure rate. Planting of a single species can also be counter-productive.

In many cases habitat change may also represent a regime shift that is not easily reversible. For instance, once a seagrass meadow is lost, increased sediment resuspension and decreased nutrient processing act as positive feedback loops that prevent reestablishment even with intensive restoration efforts.

Examples of use

Habitat restoration, especially mangrove restoration is widespread in tropical coastal waters. These activities are often undertaken as community-based projects where local communities become involved in the project and watch the results with interest.

ASEAN Mangrove Network (AMNET)

Indonesia has initiated ASEAN Mangrove Network (AMNET) since 2013.

AMNET aims to:

1. Support, promote and build the existing conservation and rehabilitation of mangrove ecosystem management in ASEAN.
2. Become a platform for bringing better environment and livelihoods for the people living along the coastal areas of AMS.

Mangrove restoration is much more common than that of seagrass or coral reef restoration, although seagrass and coral reef restoration are also carried out in parts of Southeast Asia. Because restoration of coral reefs tends to be labor-intensive and requires underwater apparatus, it is restricted to a few demonstration sites along the coast, often near tourist hot spots.

E16. Artificial reefs

Ecological well-being: Overfishing
Human well-being: Conflict among subsectors

What they are

An artificial reef is a man-made underwater structure, typically built to promote marine life in coastal areas. Submerged shipwrecks are the most common form of artificial reef. Oil and gas platforms, bridges, lighthouses, and other offshore structures often function as artificial reefs. Specially built artificial reefs are commonly made from metal or concrete.

Purpose

Artificial reefs are used for many purposes, including fish attraction devices, controlling erosion, blocking ship passages, blocking the use of certain types of fishing gear (e.g. trawl nets), or improve surfing. They are thought by some to increase fish populations in and around the artificial reef, but there is little scientific evidence to support this.

How they work

Depending on the purpose, in a fisheries context, they either work to block certain types of fishing gear, such as trawl nets, or they form habitats that mimic natural reefs to varying degrees.

Advantages

Artificial reefs are very obvious structures and are usually popular with fishers. However, this could be for the wrong reason, as they might actually increase fishing pressure by concentrating fish in known areas by acting as fish attracting devices (FADs). FADS are designed to help attract fish and improve fishing rather than restore fisheries. Where they are installed to block certain

types of fishing, they are often very successful and provide benefits to small-scale artisanal fishers and communities.

There are a number of effects associated with artificial reefs:

- They improve the marine life in a certain area;
- They provide a new location for fishermen to fish, which works to ease the pressure on natural reefs;
- They are a great way to get rid of large objects that would otherwise be placed on landfills; and
- Artificial reefs can be just as beautiful as the natural varieties and so help towards fostering tourism and diving.

Disadvantages

Artificial reefs have not been unequivocally shown to restore or enhance fisheries that are overfished. The debate continues regarding the extent to which artificial reefs benefit fishers. The precautionary approach should be applied to the deployment of artificial reefs; their most valuable proven function is probably to control trawling.

Some people and organizations believe that artificial reefs have very little benefit and instead do more harm than good. Some of the concerns associated with artificial reefs include:

- The materials used in artificial reefs can cause harmful damage to the ecosystem especially when tires are used;
- Some businesses use artificial reefs as a reason to dump their debris in the ocean;
- If an artificial reef site is not chosen correctly, it can cause damage to the marine life and other reefs in the close vicinity; and
- Due to the amount of fish that artificial reefs attract, there are concerns that it could lead to overfishing.

Examples of use

Artificial reefs can be found in many countries of the world. Most commonly, they are submerged ship reefs. Specially built artificial reefs have been promoted for centuries in Japan, where they have been used to enhance fishing, in combination with restocking. Many Southeast Asian countries have implemented artificial reef programmes. When effectively managed, artificial reefs are thought to have enhanced habitats and biological productivity. A good example is Malaysia, which has installed a number of large artificial reefs in coastal waters that are providing a number of benefits.

E17. Managing non-fishery uses

Ecological well-being: Excess catch of spawners and juveniles/ Loss of critical habitats/ Impacts of fishing on ecosystems
Human well-being: Conflict among subsectors

What they are

There are many other uses, other than fishing that can degrade critical habitats and impact on fish populations. Mangroves, for examples, are harvested for timber and fuel wood and large areas are cleared by to make way for coastal development, agriculture and aquaculture. Management of these other uses is essential, if they are part of the causes of fisheries declines.

Purpose

As for restoration of critical habitats, the obvious purpose of managing other uses is to restore degraded critical habitats, both in structure and function, to a state before degradation occurred.

How they work

When non-fisheries uses are part of the causes of fisheries declines, management of other these uses requires cooperation and collaboration with both the private sector and other government agencies that have the responsibility to manage these other uses.

In some cases, cooperation and collaboration can be achieved by being an actor in such activities as integrated coastal management (ICM) or marine spatial planning (MSP). In other cases, structures and arrangements will need to be developed through EAFM planning and implementation.

Advantages

As with direct habitat restoration, there are many advantages in addressing other uses of critical habitats that are causing damage. The main benefits are in restoring fisheries resources and increasing biodiversity.

Disadvantages

Working cooperatively and collaboratively with other agencies is time consuming and expensive. Especially in areas where fisheries are a minor economic player compared with other uses (e.g. coastal development), fisheries can have little influence over these more dominant and politically connected players.

Examples of use

ICM activities are common throughout the world and in many cases, they provide an opportunity for partnership. Probably, the best example is in the partnership with aquaculture in Asia, where good practices now minimize the loss of critical habitats.

Many ICM projects initiated by government and NGOs have been carried out in Southeast Asia over the last 20 years. One well-known example is the application of ICM to dozens of sites across East Asia, covering more than 31,000 km of coastline and benefitting tens of millions of people living in coastal and watershed areas, through the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA).

E18. Protecting, introducting and culling of key ecological species

Ecological well-being: Fishing down the food chain

What it is

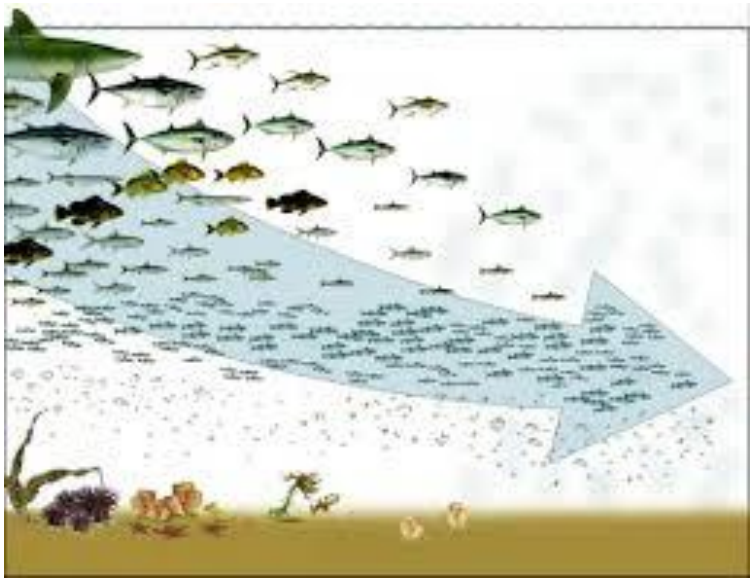
Deliberate protecting, introducing or culling of key ecological species in the marine environment. A key ecological species is a species that plays a critical role in the food chain, either as a prey or predator. Key ecological species are defined as species that have an extremely high impact on a particular ecosystem relative to its population. Key ecological species are critical for the overall structure and function of an ecosystem, and influence which other types of plants and animals make up that ecosystem.

Purpose

The main purpose of protecting, introducing or culling of key species is to restore ecosystem structure, balance and function.

How it works

Protecting key ecological species works by allowing certain species to rebuild in order to restore the balance in an ecosystem. Introduction of species is similar to restocking and stock enhancement where fish or other aquatic mammals are produced and then released into the environment, but for a different purpose. Culling is carried out by selectively removing certain species that have become too abundant as a result of other perturbations to the ecosystem.



Advantages

In general, although the concept is inherently attractive, the risks often outweigh the advantages. Protecting or culling of some species is probably less risky than other more invasive interventions.

Disadvantages

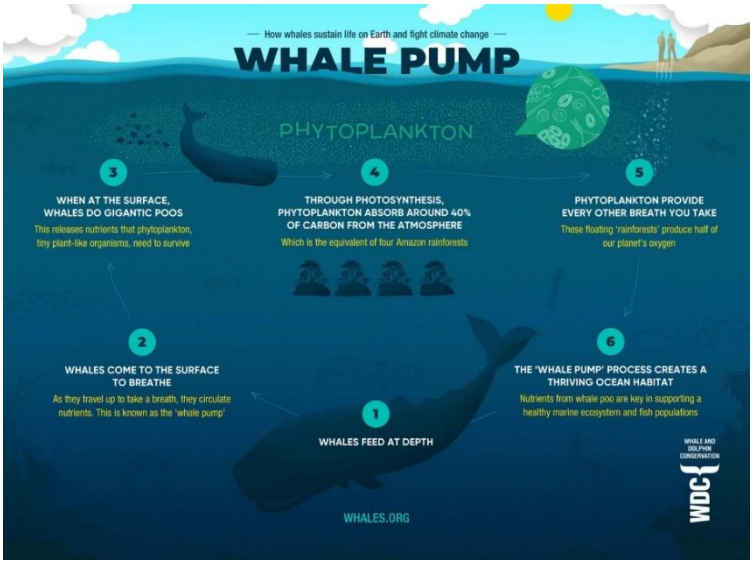
Ecosystems are very complex systems, and the result of any intervention is difficult to predict. Introducing species to the marine system, unless justified by a total destruction and necessary reconversion of an ecosystem, has been recognized as very risky. The expected advantage must be carefully weighed against its risk because such introductions are practically impossible to confine or reverse, and may have more negative consequences than positive ones.

From animal rights perspective, culling has been criticized in that killing animals for any reason is cruel and unethical, and that animals have a right to live, although some argue that culling is necessary when biodiversity is threatened.

Examples of use

Protection of whales, world-wide, is often promoted as a means of enhancing the phytoplankton productivity in the oceans. Culling of certain species, such as seals is also carried in countries such as Canada where it is claimed that seals are responsible for the decline in fish populations.

Deliberate introductions are much more common in inland waters and terrestrial ecosystems where there have been some success and some notable failures.



E19. Modified handling techniques of endangered, threatened and protected species (ETPs)

Ecological well-being: Killing endangered, threatened and protected species (ETPs)

What it is

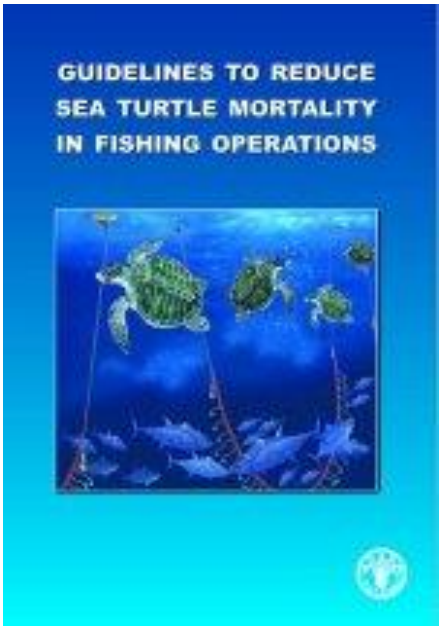
Some endangered, threatened and protected species (ETPs) can be returned to the sea unharmed, if they are treated correctly after the are caught by fishing gear.

Purpose

The main purpose is to maximize the chance of an EFTP species being returned live to the sea.

How it works

Different species require different handling protocols. Guidelines are available for different species (e.g. Ocean Watch Australia 2003: Handling protected species manual). A widely used guidelines was produced by the Food and Agriculture Organization of the UN that encourages fishers to release live turtles found caught in their fishing gear by describing how to bring sea turtles onto boats, release them from netting and remove hooks from their mouths (FAO 2009).



Advantages

Research has shown that the survival of different EFTs can be increased by correct handling and releasing from fishing gear. This is often coupled with protocols to increase the safety of the crews in fishing boats.

Disadvantages

Fishers traditionally did not have concerns over the well-being of ETPs. Public awareness campaigns and training for fishers is often required before they adopt better practices.

Examples of use

Probably the most widely used protocol is for the handling and release of marine turtles. Many fisheries worldwide have produced guidelines and fishing gear to increase their chance of survival. Some countries publish threat abatement plans for ETPs, which include best-practice handling techniques.

Governance: Tools G1 to G8

IUU fishing

Inadequate fisheries management

G1. Strengthening legislation and the judiciary

Governance: Lack of political will and financial support/Lack of inspection and surveillance capacity/ Lack of coordination across jurisdictions and stakeholders
Human well-being: Conflicts among sub-sectors

What it is

Strengthening the legislation relating to monitoring and inspection activities, governance arrangements and sanctions for non-compliance or violation of the rules and regulations. Strengthening the judiciary to deal with violations of the fisheries law.

Purpose

The legislation and the judiciary are at the core of compliance and enforcement. Strengthening both of these provides the legal power for inspectors to carry out their job, sufficient sanctions to deter violators of the laws, rules and regulations, and improved procedures for courts to deal with fishery infringements.

How it works

While the legal framework is unique in each country, a national fisheries law usually:

- Defines the powers, duties and obligations of the management authority;
- Establishes or designates the competent entity for monitoring, control and surveillance (MCS);
- Provide links to subsidiary legislation (e.g. rules and regulations);
- Designates or provides a mechanism for the designation of enforcement officers;
- Grants enforcement powers to officials (e.g. to arrest, detain and seize);
- Establishes the judicial or alternative enforcement system for penalizing those who violate fisheries rules, including the procedures and the applicable sanctions;
- Specifies sanctions to be applied to violations of the law;
- Safeguards basic civil rights of alleged wrongdoers in enforcement action; and
- Protects the interests of fishers (e.g. confidentiality of information)

The national legislation should provide competent officials with sufficient powers to carry out effective monitoring, control and surveillance functions, as well as to ensure that complete and accurate data concerning fisheries activities are collected. The national legislation should also specify sanctions that are large enough to discourage IUU fishing because the economic losses

if caught outweigh the benefits. Generally speaking, sanctions are either administered under criminal or civil law, requiring lawyers and courts, but they may also be carried out by an administrative agency. The legislation should also specify high-level governance arrangements, such as a National Fisheries Council and Provincial/state Committees (with a mix of stakeholders) that oversee the implementation of the law.

An efficient judiciary system is essential if fishery laws and regulations are to be effective. If there is no real prospect of prosecution, compliance with regulations is likely to be poor, which in turn lowers respect for regulations and negatively impacts the morale of the enforcement agencies. Unfortunately, in many countries, environmental crimes do not tend to be a high priority for most elected officials and are difficult to prosecute because multiple agencies are involved in the process. Environmental law is also a rapidly expanding field and many judges and attorneys are not trained or regularly updated on environmental policies or the technical and scientific advancements in fisheries.

Advantages

There are many advantages in having a strong legislation and judiciary system in place to support compliance and enforcement activities. The most important of these are the granting of powers, specifying sanctions and governance arrangements.

Disadvantages

The main disadvantage is that changing national fisheries legislation often takes a long time to implement. Fisheries law is often not a high priority for governments, and as legislation has to be passed by governments; hence there is often a long delay.

Examples of use

Most developed countries have modern fisheries legislation that complies with international norms and standards. Many developing countries, including ASEAN countries, have either recently updated their legislation or are revising it now ready for Government procedures. The

European Union “Red card” and “Yellow card” have been a major driver of this change, as they will not lift the card status until the legislation is up to international standards.

In terms of strengthen the judiciary system, some countries have addressed the problem by creating special environmental court systems. South Africa established the Environmental Court in 2003 to prosecute abalone-related offences. Abalone cases previously had a low priority in the judiciary system—the conviction rate was 10 percent and sanctions were generally lenient. The court completed 166 cases with a conviction rate of 75 percent in the first 18 months of its creation. A recent report on fisheries management in Chile concluded that training and increased awareness among judges and district attorneys was needed and a stricter application of the law would be required to substantially reduce illegal fishing. International organizations, such as TRAFFIC and Wildlife Alliance, are building capacity by providing technical assistance to government agencies through workshops that bring together representatives of the judicial sector and train them on administering sanctions, prosecution, investigation, and environmental laws.

G2. Participatory monitoring, control and surveillance (MCS)[1] planning and implementation

Governance: Lack of political will and financial support/Top-down MCS

Human well-being: Conflicts between sub-sectors

What it is

Involving stakeholders in all phases of fisheries management[2] and MCS planning process to achieve compliance. These include the formulation and implementation of rules and regulations, identifying IUU activities, prioritizing the activities, selecting appropriate MCS strategies, and implementing the MCS activities.

Purpose

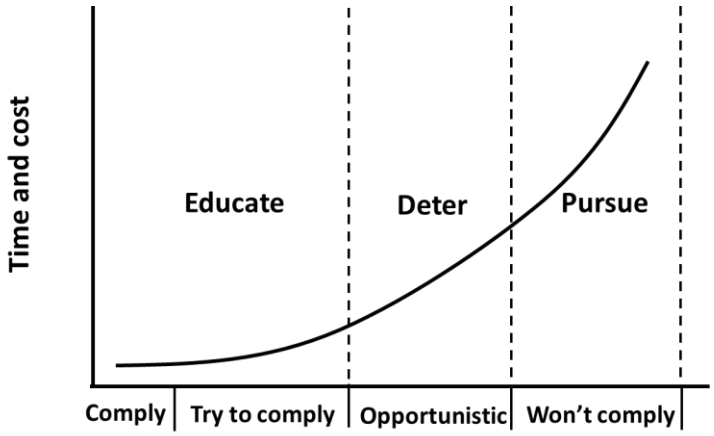
The aim of involving stakeholders in the MCS process (through co-management) is to maximize voluntary compliance and minimize the need for, and costs of, top-down enforcement.

How it works

There are two components of fisheries compliance and enforcement: (i) the tools, methods and technologies of MCS used to identify violators and enforce regulations, and the (ii) mechanisms and approaches used to achieve compliance. In the past, the focus has been on enforcement, usually developed through the implementation of centrally developed fisheries policies and management strategies, with tough top-down enforcement (see Annex 2 for definition), legal actions and sanctions, through agencies such as the coast guard, police and navy. More recently, there has been a shift towards applying mechanisms and approaches to achieve voluntary compliance.

To understand what is needed to enhance compliance, it is useful to recognize that people tend to fall along a spectrum from those who "do comply" to those who "won't comply", as shown on the x axis of the figure below. At one end of the spectrum are the people who "do comply". For them, their compliance is voluntary and can be enhanced by education, incentives and awareness. Those in the middle, who will conduct IUU fishing if the opportunity presents itself, can be deterred by the threat of penalties and sanctions. For those in the "won't comply" category, active enforcement is often necessary.

[1] MCS = Monitoring, control and enforcement is summarized in Annex 2.
[2] Participatory approach to fisheries management is discussed in Annex 3.



There is a need to balance enforcement and voluntary compliance, and to encourage an environment where maximum compliance from fishers occurs. The following have been suggested for those wishing to employ non-monetary and voluntary compliance to supplement costly traditional enforcement. (Hatcher et al. 2000; Ghambi and Mzengereza 2016; Viswanathan et al. 1997):

- Socialize fishers and fisheries stakeholders to comply with fisheries regulations and rules, building awareness of the societal (both at collective and individual levels) and environmental effects of breaking them, together with awareness of shared responsibility and the importance of individual contributions.
- Ensure that the expected monetary and non-monetary costs are greater than the potential illegal gains.
- Build fairness into the procedures used to develop and implement rules and regulations.
- Greater involvement of fishers in the management process to increase levels of compliance with regulations through greater legitimacy and reflection of the interests of those who are directly impacted.

Education and outreach are critical to foster community buy-in as well as to inform stakeholders of rules and regulations. If fishers see that the sanctions are working, they will be more willing to report violations. But if they report them and nothing happens, they tend to lose faith in the system and are not encouraged either to report others' violations or follow the regulations themselves. Once fishery regulations are in effect, agency enforcement teams should consider developing a simple education and outreach plan directed toward local fishers, foreign fishers, and the community alike. Distributing information to all stakeholders on zoning, regulations, restrictions, and fines through the most appropriate forum, whether simple fact

sheets, town meetings, or webinars, can increase compliance. Engaging enforcement officers in outreach activities can help foster positive relationships between fishers and law enforcement. Bulletin boards can be placed near key ports and fishing cooperatives to broadcast regulations, and pamphlets can be provided at airports and tourism kiosks. Outreach can also be targeted to local primary and secondary schools with exhibits, videos, and informal discussions. Branded merchandise

Advantages

Having stakeholder understanding the need for rules and regulations and then being involved in planning on how to get better compliance to these rules and regulations result in better voluntary compliance. If stakeholders are aware of, and encourage compliance, their voice should be heard. This applies to both large-scale commercial and small-scale artisanal fisheries. They reduce enforcement expenditures, and encourage working at the community-level instead of the individual level.

The other major advantage of having stakeholders “buy in” is that it could influence politicians to be more supportive of MCS.

Disadvantages

As explained in the figure, there are always going to be a section of society that will not comply voluntarily, even if they are heavily involved in the process. If budgets decline because “enforcement is not needed”, then the whole system could collapse.

Examples of use

Many countries use co-management as a means to achieve better compliance. Developed countries such as Australia, USA, Canada and Europe where large-scale commercial fisheries often dominate, stakeholders are actively involved through co-management. In Australia, for example, the Commonwealth fisheries are managed by a statuary authority (Australian Fisheries Management Authority or AFMA) governed by a Commission consisting of government, industry and science stakeholders. AFMA stakeholders are involved in developing fishery management and MCS plans.

In countries where there are more small-scale artisanal fisheries, bottom-up involvement in planning is increasing. In some countries, enforcement of regulations by fishers is becoming increasingly common. In some cases, fishers are deputized to undertake enforcement, while in other cases they can only report illegal activities. Examples exist in most ASEAN countries, including Thailand. In Baan Nai Nang, Krabi, Thailand, the provincial fisheries officers realized that management focusing on enforcing rules and regulation alone is not the only way to solve problems and is not guaranteed to be effective. Fair, effective and consistent enforcement stopped destructive fishing methods and brought about benefits to all. These clear benefits

motivated people to comply with relevant laws and to support law enforcement efforts to stop illegal fishing and maintain the benefits derived from protected resources (Sringam*, pers. comm*).

In another example, a study in Nkhata Bay district, northern Malawi was conducted to examine how enforcement and compliance with fisheries regulation affected the sustainable exploitation and conservation of the fisheries resources in Lake Malawi. The results show that self-interest and awareness of regulations contribute to compliance of fisheries regulations by resource users, while insufficient funds, personnel shortages and limited support by stakeholders all negatively affect the government's enforcement of regulations. (Ghambi and Mzengereza 2016).

G3. Inspection and surveillance tools

Governance: Lack of inspection and surveillance capacity

What it is

Tools that can be used for inspection and surveillance of illegal, unreported and unregulated (IUU) fishing.

Purpose

Inspection and surveillance tools are used to encourage compliance, and if needed, provide evidence for legal proceedings.

How it works

Inspection and surveillance tools can be grouped into four categories:

- Before fishing (Port-out);
- During fishing;
- During landing (Port-in); and
- Post-landing.

Before Fishing inspections of fishing vessels can be used to check the fishing gear and effort control mechanisms (e.g. type and characteristic of gear, horsepower and vessel capacity) to ensure that regulations or license conditions are being complied with. They can also be used to gather information for subsequent surveillance.

Before fishing inspections are also useful for public relations and can help build trust between fishers and the monitoring, control and surveillance (MCS) organization and personnel. They provide an opportunity for awareness raising such as distributing legal and administrative information. Legal fishers can also be enlisted to help in planning or fisher intelligence.

While Fishing inspection and surveillance tools include:

- Logbooks;
- Patrol vessels
- Patrol aircraft;
- Observer programs;
- Vessel monitoring systems (VMS) and automatic identification systems (AIS);
- Satellite imagery and remote sensing;
- Beach patrols; and
- Navy and coastguard.

Inspection and surveillance carried while fishing can act as a deterrent and/or enforcement of many control measures. It is the only method that allows infringements in relation to logbooks, gear types and catch to be detected on the site of the crime (while fishing). Important information is also collected at sea that can be time, date and position referenced.

During Landing (Port-in) inspection and surveillance**,** whether it is a small landing site or a large port, provides a convenient point in the fishing operations where vessels can be checked, documents such as logbooks collected, and the fish being landed identified and weighed. Surveillance of landings is one of the most important elements of MCS operations when output controls are in place. It is also useful for checking on input controls and technical measures.

The capture of data at the point of landing is becoming easier through the use of mobile applications that allow monitoring of catch data as well as other functions such as business and loan reports.

Post Landing inspection and surveillance at different points along the value chain, such as fish markets, transport providers and sales organizations can provide valuable information about IUU activities. This type of operation generates information for biological and economic cross-checks as well as validation of other MCS information.

It can also be a viable control of illegal fish, especially undersized and protected species. This is especially valid in small-scale and semi-commercial domestic fisheries with high-value catches such as lobster, tuna, sharks and swordfish.

Roadblocks or border checks can be useful for checking licenses and permits as well as the catch itself.

Again, as with capturing catch data at sea and point of landing, data capture along the post-landing value chain is now being facilitated by on-line applications.

Advantages and disadvantages

There is a wide range of available surveillance and inspection tools. Each has its own strengths and weaknesses, as well as varying degrees of cost. Deciding on what tool to use, when, and where to use it, must be done during a MCS planning process, preferably with stakeholders. This involves the same steps as developing an EAFM plan – identifying IUU activities, prioritizing the activities through a risk assessment process, setting objectives and linking these to the appropriate tool to address that objective, and then closing the loop through monitoring and evaluation (M&E).

Examples of use

Every country and every fishery in the world uses one or more of these tools in their MCS. New technologies are being incorporated into both inspections and surveillance and cheaper technologies are being rapidly being introduced for small-scale artisanal fisheries.

No application of one single tool is effective. Countries that just rely on one (or two) tools, such as patrol vessels, are not successful. In some cases, the country has chosen one of the most expensive tools (again, for example patrol vessels) that cannot be sustainably funded and supported. A combination of port-in and port-out (PI-PO) is proving to be a very effective MCS tool in Thailand, where the same vessel can be inspected both before and after fishing.

G4. Monitoring, control and surveillance (MCS) partnerships

Governance: Lack of political will and financial support/Lack of inspection and surveillance capacity/ Lack of coordination across jurisdictions and stakeholders

What it is

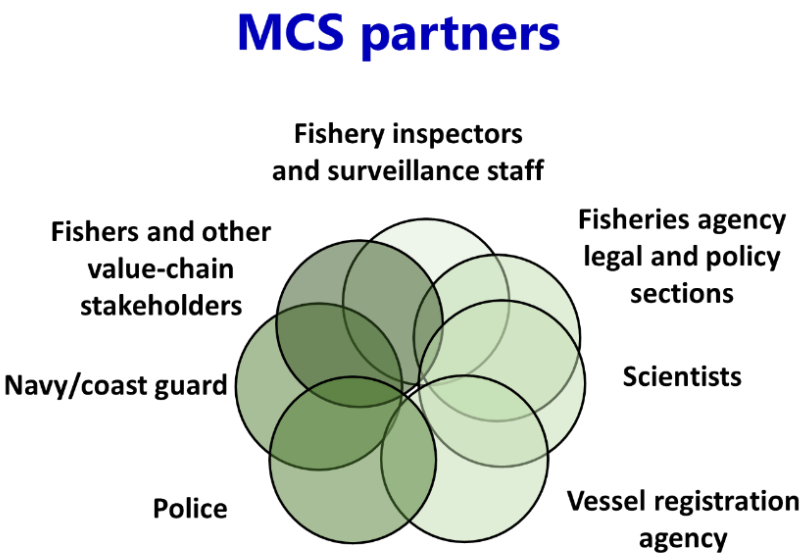
Partnerships among several agencies and stakeholder groups involved in MCS activities. These can be either permanent partnership arrangements or more temporary task forces that address a specific IUU problem**.**

Purpose

Partnerships provide the authority for the inter-agency mechanism to develop and coordinate MCS planning and implementation. Partnerships also provide the necessary conditions for good communications and transparency and can address issues of corruption. They can be used to readily share knowledge and information on the fishery and its users.

How it works

Possible partners to be engaged in MCS are shown in the figure. Each partner brings with them important MCS assets (technology, boats, staff, sea safety, information) that can be combined to provide a strong MCS network.



Partnerships can be either long-lasting formal arrangements or more transient task forces.

Formal arrangements

Formal partnerships need to be established with an agreement regarding the functions, obligations, responsibilities and risks of those involved. Signing a memorandum of understanding (MOU) that spells out the commitments and obligations of each partner is a good basis for the partnership. This should include a statement of the purpose of the partnership and communication details.

MCS Task Forces

A task force is a temporary grouping of units under one commander, formed for the purpose of carrying out a specific operation or mission. The most successful task forces involve all of the different sectors of the community affected by the issue.
The four basic elements of a successful task force are:

- Centralized chain of command ;
- Clear mission and objectives;
- Intelligence driven; and
- Built on trust.

Global and regional alliances

IUU fishing is not just a local issue. While some IUU activities occur locally, many occur from incursions of foreign boats into national jurisdictions and also on the high seas. IUU fishers often are part of an organized crime syndicate that works globally.

The International MCS network is a voluntary network of member countries committed to improving the efficiency and effectiveness of fisheries-related MCS activities through enhanced cooperation, coordination and information collection/exchange. Many countries have also signed up to the FAO Port State Measures Agreement, which is the first binding international agreement that specifically targets IUU fishing. It lays down a minimum set of standard measures for Parties to apply when foreign vessels seek entry into their ports or while they are in their ports.

The ASEAN Network for Combating IUU Fishing (AN-IUU) was adopted at the 41st Meeting of the ASEAN Ministerial Meeting on Agriculture and Forestry (AMAF) and is now in an implementation phase.

MCS Information Sharing

Information sharing is vital to the success of both the permanent partnership arrangements and more transient task forces. Different agencies hold different types of data and information. For example, it is common for fishing vessels to be registered through a transport agency and then fishing permits issued through the fishery agency. These important registers need a common database.

Advantages

Having well-defined partnerships is essential to successfully combat IUU fishing. Enhanced coordination and cooperation can save money, promote political will and provide a force big enough to deter IUU fishing.

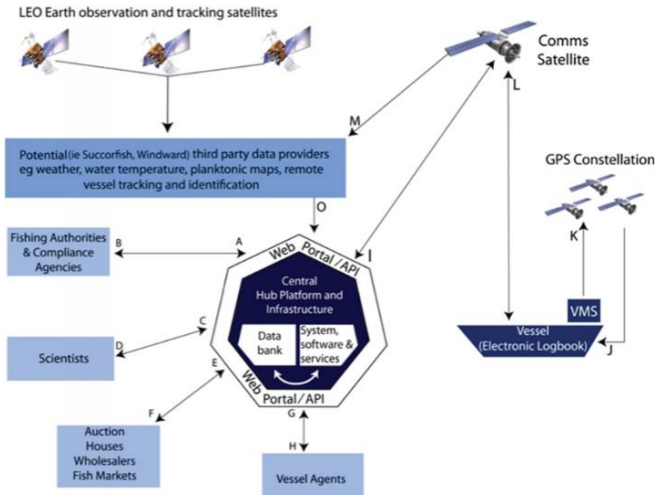
Disadvantages

Setting up of formal or informal partnerships requires a clear understanding of each partner's role and responsibility. Communication and information sharing requires a dedicated effort that is often lacking in partnership arrangements.

Examples of use

Some form of partnership exists among the players in MCS that are operating at various levels in most countries. More advanced partnership arrangements have solid MOUs and effective communication and reporting requirements. As mentioned above, ASEAN has now started to implement a regional MCS network arrangement.

Many countries are moving towards an integrated web-based portal system that links different users, including those responsible for MCS, to a shared data base (see diagram of an example in development in the North Sea).



Thailand formed a Centre to Combat IUU fishing in 2015, which brought together the Royal Thai Navy as the focal point, with another five law enforcement agencies, namely, the Royal Thai Marine Police, Customs Department, Maritime Department, Department of Fisheries and the Coastal and Maritime Resources Department.

G5. Governance institutional arrangements

Governance: Lack of political will and financial support/Lack of coordination across jurisdictions and stakeholders
Human well-being: Conflict among sub-sectors

What it is

A framework of institutional arrangements set up both vertically (across jurisdictions) and horizontally (across stakeholders).

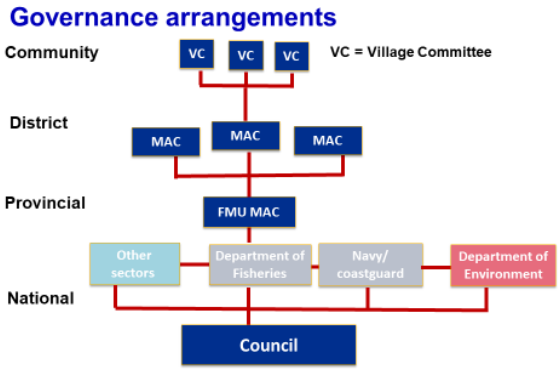
Purpose

To promote better coordination and cooperation in the governance of EAFM.

How it works

Cooperation and coordination, both vertically across different jurisdictional levels (e.g. communities to national) and horizontally across relevant agencies involved in EAFM (e.g. across fisheries, environment and tourism) will need structural arrangements in place that formalize the coordination and facilitate participation.

A hypothetical governance arrangement is shown in the figure below. At the community level, villages have "Village Committees" (VCs) (could be two committees – one for men and one for women). Selected individuals of these VCs would be then be represented on "Management Advisory Committees" (MACs) at the district/municipality level. In turn, selected individuals would be represented at the Provincial/state level. This could also be the area designated as a fishery management unit (FMU), and in that case it could be a FMU MAC.



At the national level there could be a national EAFM committee with representatives of fisheries, environment, navy/coast guard, tourism etc. At the highest political level, an overarching council made up of politicians from relevant ministries could be providing policy

guidance and direction. Where the FMU straddles two or more countries, a joint MAC will be needed to coordinate management across national borders.

Advantages

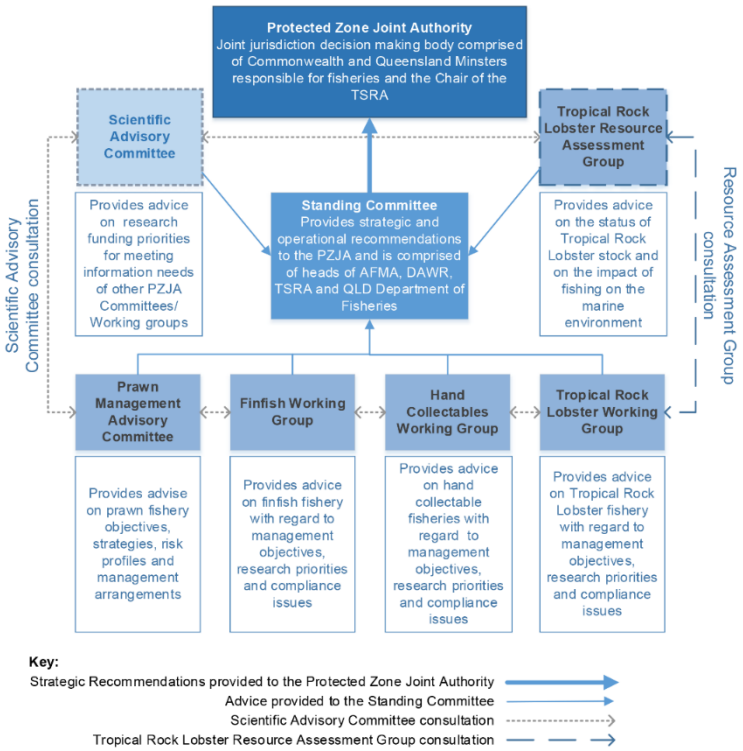
Having a formal institutional structure facilitates better communication, conflict resolution and negotiation needed to secure good fisheries management outcomes.

Disadvantages

Setting up institutional arrangements is very challenging. Constraints include high costs of bringing people together, willingness of stakeholders to be involved (especially if they are losing money by not actively fishing or working), and deciding on who should represent the committee at the next level.

Examples of use

Many countries have some of structure in place. For example, the Philippines has good examples of network of stakeholders at the district/municipality and state/Provincial levels. Thailand has a good National Fisheries Committee and Provincial Fishery Committees. Many developed countries such as Canada, USA, Australia, New Zealand and some European countries have extensive networks of committees and councils that link local fishers/communities with national councils. Large countries, such as the USA, have



subdivided the country in regions, which are governed by Regional fishery management Councils and subordinate committees.

G6. Monitoring and evaluation of management performance

Governance: Lack of management-related data

What it is

As part of the management cycle of setting objectives and selecting a set of indicators, monitoring and evaluation (M&E) is the final step that completes the cycle. This M&E provides a common source of information to assess the performance of the fisheries management.

Purpose

To collect data and information to track fisheries management performance and to inform better management decisions.

How it works

Fisheries management involves a complex array of ecological, human and governance objectives, all of which require data and information to assist in setting the objectives in the first place, and then in informing management decisions in evaluating whether the management is working or not. The EAFM management framework (see table below) shows the links between the goals and measure of performance (how well is the goal being met). This framework can apply to the ecological, human and governance components.

Element	Intention
Goal	Broad statement of intent.
Threat or issue	Major issue of relevance.
Core problem and causes	Core problem underlying the issue and its causes
Objective	Objective that can be addressed by management, usually addresses a core problem.
Indicator	Something measured to track an operational objective. These can be quantitative or qualitative.
Reference point/Bench mark	Target, limit or triggers (e.g. for management actions in a harvest control rule) values for indicators. These can be quantitative or qualitative.
Performance measure	Relationship between the indicator and reference points that can be used to track progress.

In this framework, performance measures are used to inform managers and policy makers on how well the goals and objectives are being reached.

Modern fisheries management for the fisheries resource component of EAFM has more recently included the development of harvest control rules (HCRs) as part of the management cycle (the cycle also known as a Harvest Strategy in some countries) that are pre-agreed guidelines that determine how much and what type of fishing can take place. These are based on the indicators of the status of the fisheries resource.

Having the indicators as part of the management decision making process, both in the plans and in day-day decisions, means that these indicators must be monitored and, as such, they provide a strong focus on what data and information is needed.

Advantages

Having indicators as a key part of the management cycle, especially in M&E increases the probability that the data and information collected for the fishery is relevant and timely. More importantly, they provide the basis on which to assess whether the management is working or not, and provides information on how to improve management. If a set of indicators is agreed, there is a greater chance that they will be monitored and fed into the management process.

Disadvantages

M&E can be expensive (both in terms of staff and finances), and often does not have enough budget. This results in the incomplete and poor quality of information. Even though the set of indicators is well-formulated in the EAFM plan, a lack of coordination between scientists/ fishers and policy makers, as well as the required resources, often means that critical indicators are not monitored or data are not being applied in decision making. These gaps between those responsible for management and those responsible for generating data or those with traditional knowledge are a major cause of the apparent lack of data and information for management decisions.

Having a set of indicators, can excludes other important sources of data and information, especially the qualitative data from experienced fishers and social data from communities on the ground. These also need to be considered in any M&E.

Examples of use

Many countries have formal reporting on management performance based on indicators and benchmarks. There is a modern trend for “triple-bottom line” reporting where the three components of EAFM are reported, but this is not yet common throughout the world.

In ASEAN, a good example of using indicators and M&E reporting is in the Gulf of Thailand and Andaman Sea fishery, as in the following report summary.

	Target reached		***Good progress***		***No progress***

Goal and objective	**Status**
Goal: Reform Thailand’s marine fisheries into a limited access regime where the fishing effort is commensurate with the MSY	
Objective: Reduce fishing capacity and fishing effort	
Objective: Rebuild fish resources through artificial reefs and restocking programs	
Objective: Reduce the catch of juveniles of the larger commercial species	
Goal: Prevent, deter and eliminate IUU fishing	
Objective: Minimize IUU fishing through effective MCS	

Goal: Increase benefits for and reduce conflicts among major stake holders	
Objective: Resolve conflicts between small-scale and large-scale fishers	
Goal: Improve the marine environment	
Objective: Restore and maintain critical habitats	
Goal: Strengthen capacity to sustainably manage fisheries	
Objective: Improve fisheries data and information	
Objective: Strengthen fisheries management capacity	

G7. Fisheries information systems (FIS)

Governance: Inaccessible data and information

Human well-being: Conflicts between sub-sectors

What it is

A system that brings together much of the data and information needed for fisheries management.

Purpose

To provide a single source of data and information for policy makers and fisheries managers (and other users, as appropriate).

How it works

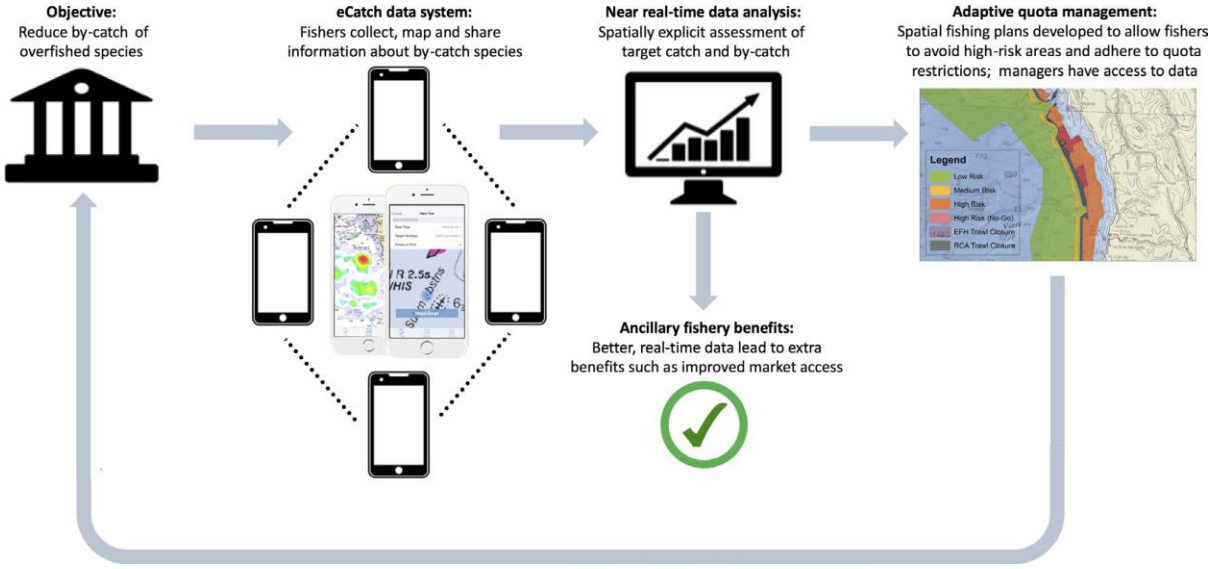
There is a wide range of data and information used in fisheries management, as well as a wide range of sources for these. More often than not, these are not accessible to the people that make policy and management decisions. A FIS brings together data and information and makes these available through a central portal or series of portals.

Some examples of the types of fisheries data and information for fisheries management are:

- Fisheries dependent data
  - Annual production and value statistics reports (catch, value and sometimes fishing effort)
  - The fishing operators' data (eg landing or log-book records)
- Fisheries independent data
  - Fishery surveys
  - Specific sample data collected by a research agency.
- Regular population census reports (employment and livelihoods)
- Economic data
  - Costs, revenues and rent
  - Trade data
- Social and demographic data
  - Population
  - Education
  - Employment
  - Networks
- Livelihood data
  - Domestic food supply and fish consumption
  - Dependence on fishing and related activities
- Environmental data

- Critical habitats
- Pollution

Mobile technologies including smartphone/tablet applications (apps) can collect, store and analyze large quantities of real-time or near real-time fishery-dependent data, while capturing the spatial and temporal dynamics of catches.



Advantages

Having data and information at the fingertips of policy makers and decision makers has enormous benefits, both for fisheries management and the marine environment as a whole. It promotes better planning, more informed decision making, and better communication of policies and management performance.

Disadvantages

Collating all the different sources of information and maintaining them to be current and up-to-date is a major undertaking. Often, a FIS depends on data coming from collaborating partners, and if they do not provide the data, then the incomplete dataset in the FIS makes the system useless.

Examples of use

There are many global FISs that are regularly used in fisheries management. Basic catch data for every country of the world is available from the FAO http://www.fao.org/fishery/statistics/en. The Sea Around Us Project (SAUP) provided re-constructed catch data that is disaggregated into sub-sectors (subsistence, small-scale artisanal and large-scale commercial) http://www.seaaroundus.org/. This website also has other information useful for fisheries management such as marine protected areas (MPAs)

and some large-scale indicators such as ocean health. The FAO also has several portals such as FIGIS (Fisheries Global Information System) developed to improve and interconnect all its databases and products.

At the regional level, many RFMOs have A FIS for their members. For example, the International Pole & Line Foundation (IPNLF)at http://ipnlf.org/what-we-do/projects/fisheries-information-system. SEAFDEC has its own fisheries statistics FIS at http://map.seafdec.org/fisherybulletin/ that, unfortunately suffers from the main disadvantage of incomplete data described above.

There are good examples of FIS in use in many countries of the world. These range from catch and effort data used by policy makers in setting policies and researchers in assessing the status of the fishery resources. For example, https://qfish.fisheries.qld.gov.au/ to a FIS that links vessel registration data (often housed in the transport agency with fishing licensing data, often housed in a fisheries agency. In the USA the National Atmospheric and Oceanic Administration (NOAA) has a comprehensive FIS that works collaboratively with partners at the federal, regional, and state levels to ensure every stakeholder can easily access comprehensive, high-quality, timely fisheries information https://www.fisheries.noaa.gov/national/commercial-fishing/fisheries-information-system-program.

Electronic catch recording systems are now active many countries and increasingly being integrated into systems that trace fish from harvest to consumer. Electronic FIS that assist in the compliance and management of fisheries are also growing rapidly, for example a new system in the North Sea in Europe.

G8. Management institutions and arrangements

Governance: Lack of appropriate institutional structures

What it is

An arrangement that fosters the coordination of all the different activities involved in fisheries management.

Purpose

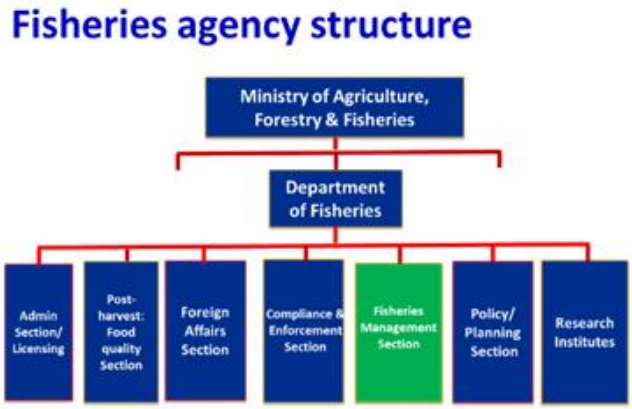
Fisheries management covers many different activities, and unless adequate arrangements are in place, lack of coordination often results in bad management.

How it works

Fisheries management is an integrated process that includes a number of activities that are grouped under the following six components:

1. Formulation and implementation of laws, rules and regulations
2. Policy & planning
3. Collecting and analysing data and information to inform decision making
4. Allocation of resources
5. Compliance and enforcement of the rules
6. Stakeholder engagement

In general, the structure of a fisheries agency reflects these different activities.



Modern fisheries management is a career in its own right and requires specialised education and training. Fisheries management should also be seen as an activity in a fishery agency worthy of its own office and arrangements (see green box in the organogram above). This can be a dedicated fisheries management office/section, or alternatively, a dedicated fisheries management authority, separate from government.

Coordination of the fishery management activities is best carried out at the level of a fisheries management unit (FMU). Ideally, each FMU should have its own fisheries

management/EAFM plan that is implemented and supervised by a fisheries manager for that fishery. The role of the fisheries manager is to make sure all the activities combine to meet the objectives of management.

Advantages

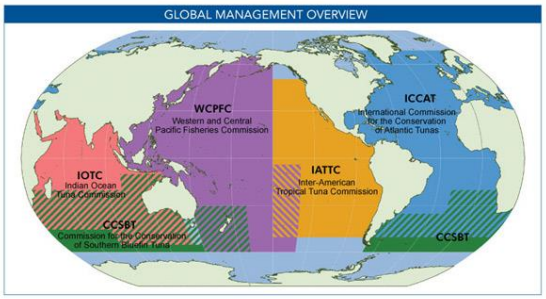
The advantages of having dedicated fishery managers and dedicated fishery management office are obvious, taking into account the complexity of fisheries systems. As seen in the examples below, this level of importance is often not given, especially in developing countries.

Disadvantages

There are no obvious disadvantages in having a dedicated fishery manager and fishery management office. The reason why the model has not been widely adopted in developing countries may relate to the fact that there are very few people trained as fisheries managers in many countries, especially where the GDP of fisheries is small.

Examples of use

The regional fisheries management organizations (RFMOs) are a good example of intuitional arrangements to improve fisheries management. These RFMO have their own offices and fishery managers to coordinate fishery management activities in their areas of competence. For example, the Indian Ocean Tuna Commission (IOTC) has its headquarters in the Seychelles, and has a number of dedicated fishery managers.



Dedicated fisheries management offices are mainly confined to developed countries. These can range from having fisheries managers housed in with other fisheries administration staff, to dedicated fisheries authorities, such as the Australian Fisheries Management Authority. There are very few fishery managers or fisheries management offices in developing countries. Often fishery scientists act as de facto managers. More often than not, these scientists have been trained in biological science, with little knowledge of the other fisheries management components such as the legal system, rules and regulations, policy & planning, allocation of resources, compliance and enforcement of the rules, and stakeholder engagement.

G9. Training and capacity building

Governance: Lack of human capacity of fishery staff
Human well-being: Lack of skills/knowhow

What it is

Human capacity building is the process by which individuals and organizations obtain, improve, and retain the skills, knowledge, tools, equipment, and other resources needed to carry out their livelihoods or do their jobs competently. Since EAFM is a holistic concept, there is a need for skills and knowledge that encompass a wide range of topics and disciplines, including economics, ecology, policy, law, sustainable livelihoods and ecosystem-based governance, as a examples.

Purpose

Increased human capacity and competency in sustainable fisheries allows individuals and organizations to perform at a greater capacity (larger scale, larger audience, larger impact, etc) and to improve and balance ecological health, livelihood opportunities and good governance.

How it works

There are a wide-range of human capacity building tools. These include:

- Focused training, often by an external training organization such as SEAFDEC;
- Higher education by encouraging staff to further their education, often in overseas maritime colleges and universities;
- On-the-job training through increased responsibilities and involvement;
- Exchange schemes to learn from other organizations, sites, FMUs, and countries; and
- Mentoring by more senior and experienced staff.

The audience (and, therefore, the focus and content) of the capacity building includes:

- Fishery managers who are responsible for coordinating all the different activities that form fisheries management;
- People responsible for one or more of the activities (e.g. scientists, fisheries inspectors, planners etc) so that they understand their roles and responsibilities and how that fits in with the overall fisheries management framework;
- Fishers and fishing community members who need skills and knowledge to improve and expand their livelihood options; and

- Other stakeholders, including NGOs, so that they have an appreciation of the vision, goals and importance of fisheries management.

Advantages

Building human capacity is an essential part of implementing EAFM. Having people who are aware of, and are competent in, different aspects of EAFM improves communication, helps build trust and facilitates better compliance with fisheries regulations and rules. Increased capacity to strengthen and diversity livelihoods of fishers and fishing communities, both in fisheries and non-fisheries related sectors, not only improve their well-being and resiliency, but also helps improve sustainable resource use and habitat restoration.

Disadvantages

Training and capacity building often needs time away from current work environment. It may also require substantial outside financial and knowhow support and investment. There are also many training opportunities and courses available, picking the appropriate options can be challenging. There is also the danger of having conflicting information spread through using training courses from different sources. As with all disciplines, fisheries management has its own set of jargon, the definitions of which may vary depending on who is providing the training. Different approaches and a different focus will also occur depending on who is giving the training e.g. a fisheries agency or a conservation agency, which may give different balance to human well-being versus ecological well-being. Additionally, many types of training and capacity building requires follow-up technical and budgetary support for the learners to effectively apply the acquired knowledge to establish and sustain related activities.

Examples of use

There is a wide array of training materials relating to ecosystem-approach to fisheries management, ranging from training on specific activities such as compliance and enforcement to more inclusive courses, such as E-EAFM, to specific training and capacity

building related to sustainable livelihoods (see references in Annex 5 on Sustainable Livelihoods Approach (SLA). Many of these can be found on the internet (Google: fisheries training).

The FAO has a lot of relevant guidelines and training material http://www.fao.org/fishery/fishcode-stf/training/en. Current approaches to human capacity development and a review of delivery mechanisms http://www.fao.org/3/y5613e/y5613e07.htm Education and Training.

There are also a number of on-line resources, such as EAFM training at: https://www.conservationtraining.org/enrol/index.php?id=109.

A number of universities and colleges have certificate level and degree courses (both undergraduate and postgraduate) available to eligible students. These are common in Australia, Canada, China, Europe, and the USA, among others. It is possible to specialize in one discipline (e.g. science and resource assessments or international law), as well as more general courses.

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Human well-being: Tools H1 to H11

Low income, profits and rent

Poverty and marginalization

H1. Taxes and subsidies

Human well-being: High cost of fishing/
Lack or limited alternatives for sustainable livelihoods

What it is

Taxes are a tool that can be used by governments to redistribute the country's wealth to be more equitably shared. It could include using taxes to provide safety nets for the poor or support artisanal fishers. Subsidies are a form of tax that transfer of money from the government to a group or individual (e.g. a fuel subsidy).

Purpose

A tool often used by governments to correct for perceived market failure in revenues and costs. The main purpose of taxation is to raise revenue to pay for the services and income that support the community needs (e.g. education, health and other welfare). The objective of subsidy is to bolster the welfare of the chosen society.

How it works

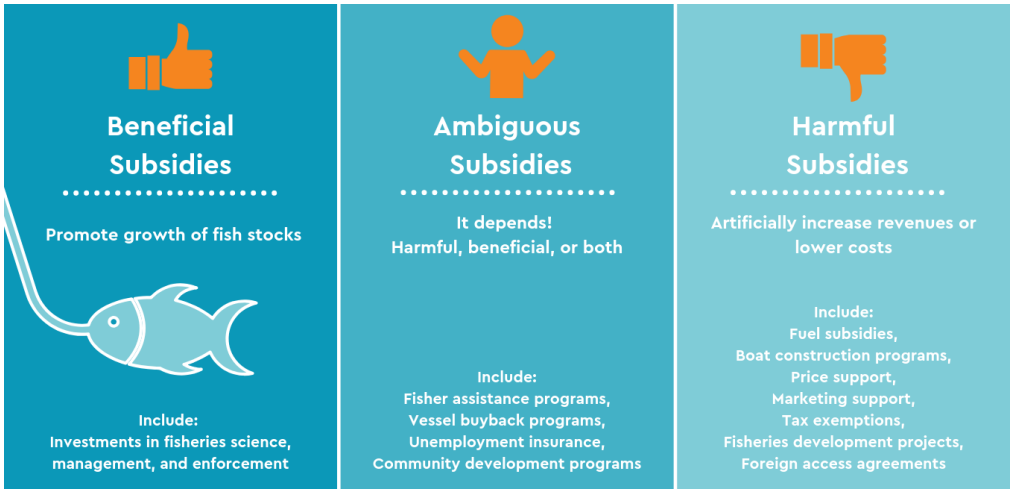
Taxes are used to the shift purchasing power from one group of people to another. One common example is taxing the large-scale commercial fishers and transferring this to small-scale artisanal fishers. These could be in the form of license fees for only large-scale vessels.

Subsidies result in reductions in cost given to one or more sub-sectors to decrease the operational cost of fishing. Most commonly, these are in the form of a fuel subsidy or access to physical capital (e.g. new engines and boats).

It is generally recognized that many long-term subsidies can be harmful to the fishery resources, by causing increased fishing capacity and overfishing, while other subsidies are non-harmful. Non-harmful subsidies are those that contribute towards increased regulation or promote reduced fishing capacity. However, there is currently no universally agreed definition of what is or is not, a harmful subsidy. The issue of harmful and beneficial subsidies is currently under review by the World Trade Organization (WTO).

Fuel-tax subsidies provide good example of harmful subsidies as they enable fishers to travel greater distances to access more resources and/or use more powerful engines. Other subsidies can be categorized as either nonharmful subsidies or uncertain on the same basis.

Subsidies classified as ‘uncertain’ include, for example, those which support research, and those that are neither harmful nor non-harmful in the first instance, but could be either depending on the specific context. For example, buy-back programmes may be nonharmful as they reduce fishing capacity, but if a buy-back is temporary and the vessel is redeployed elsewhere, increased fishing capacity may result.



Advantages

In some circumstances, subsidies can be beneficial. For example, during a pandemic, such as covid-19, supporting fishers to stay in business is a good subsidy as long as it is temporary. Government spending on research and compliance and enforcement can also be seen a beneficial subsidy.

Disadvantages

Subsidies can reduce costs, but can also increase fishing capacity and increase the catch of fish to levels that are not sustainable. Subsidies may make fishing seem more profitable than it really is and can contribute to overcapacity and overfishing of the fishery resource.

Examples of use

Subsidies are widely used by governments in many countries. The total amount of global subsidies was recently estimated to be at USD 35.4 billion in 2018, of which harmful capacity-enhancing subsidies were USD 22.2 billion. The top five subsidizing political entities (China, European Union, USA, Republic of Korea and Japan) contributed 58% (USD 20.5 billion) of the total estimated subsidy. Fuel subsidies (including fuel specific tax exemptions) is the largest subsidy type at 22% of the total global subsidy, followed by subsidies for fisheries management (19% of the total) and non-fuel tax exemptions (15% of the total). Asia, including China, is by far the greatest

subsidizing region (55% of the total), followed by Europe (18% of the total), and North America (13% of the total. A recent study has shown that small-scale artisanal fisheries only receive about 16% of the total global fisheries subsidies.

H2. Microfinance and microcredit

Human well-being: Low prices of fish products/High operating costs/Lack or limited alternatives for sustainable livelihoods/Lack of access to resources or sense of ownership

What it is

Fishery microfinance/microcredit refers to small loans without collateral, transfer services, and other financial products that are aimed at low-income fishers. Microcredit is a common form of microfinance- a very small loan from a bank or other institution to individuals to help them become self-employed or grow a small business (FAO 2008-2000).

Purpose

To enable small-scale fisheries to increase and sustain production levels, to assist those with low income to become self-employed and generate income to reduce their poverty, and to enhance community livelihood through small scale economic development (Kalhoro et al 2017).

How it works

A microfinance institution (MFI) focuses on the needs of the borrowers, not on profit, and provides services to those who are poor and more vulnerable than clients of regular banks. Some MFIs also offer savings and insurance products, business advice, and support for organizational development (FAO 2008-2000).

Before microfinance can significantly contribute to poverty reduction and fisheries management, the following constraints should be overcome through active partnerships among fisherfolk, MFIs, and other actors in the development and fishery sectors:

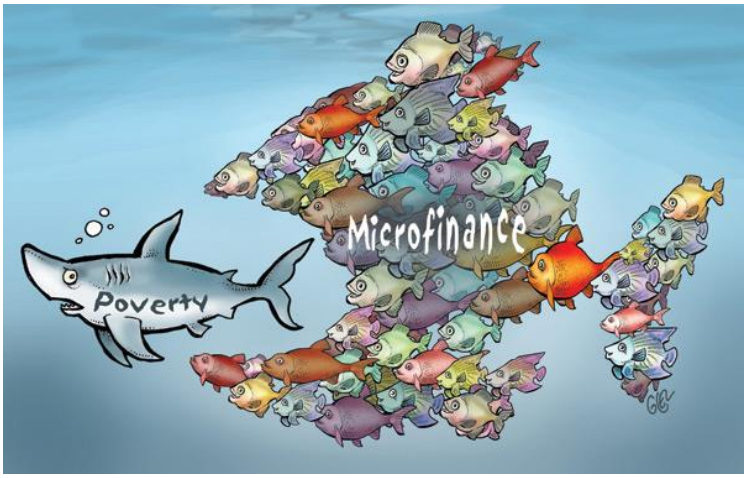
- Increased outreach and pro-poor growth supported by both an MFI operational and business development plan and a professional development plan; and
- Limited availability of other (social) services in fishing communities that could support financial service delivery.

“A core principle that has been proved by successful microfinance programs is that the poor have the capacity to repay loans, pay the real cost of loans and generate savings.” (Tietze and Villareal 2003).

The mechanics of a microfinance operation basically involve three levels: i) the borrowers who take out loans that they invest in microbusinesses; ii) the loan delivery and recovery

system; and iii) the institution or organization that manages the delivery system. The successful operation of these levels is premised on the twin principles of (i) client discipline, where borrowers take responsibility for their decisions and agreements made with the MFI; and (ii) institutional discipline where MFIs offer and provide products and services characterized by quality, efficiency and commitment." (Tietze and Villareal 2003). While the field of microfinance is diverse in approach, methodology, organizational structure and culture, the following principles have been clearly established (FAO 2008-2020).

Principle 1. Offer services that fit the preferences of poor entrepreneurs;
Principle 2. Streamline operations to reduce unit costs;
Principle 3. Motivate clients to repay loans; and
Principle 4. Charge full-cost interest rates and fees.



Advantages

Provides people with resources and tools to alleviate poverty by building their own business and to open prospects for have more than one source of income.

Disadvantages (Five Talents n.d.; Kleih, Viryak, and Kanika 2006)

- Informal financial services meet some needs but not all;
- Studies have shown that many beneficiaries use their loans to cover short term emergencies rather than to pursue long-term economic growth;
- Microcredit programs can produce over-indebtedness;
- Microcredit introduces external debt into a community and can produce unhealthy dependence;
- Microcredit can also diminish existing informal safety nets and adversely affect social cohesion;

- Microcredit loans can be expensive and rely on high interest rates to meet operation costs;
- Microcredit is rarely sustainable among the poor at modest interest rates and very rarely reaches the poorest; and
- Microcredit programs may exploit rather than empower. Financial literacy and education are often excluded as precursors to loan products. As a result, many poor become trapped in deepening cycles of poverty and debt.

Examples of use

Today, there are over 7000 microfinance institutions in the world that lend about $2.5 billion to over 16 million borrowers. Around 1200 of those institutions work in Bangladesh alone. The Grameen bank specifically now has over 1500 branches in Bangladesh and lends to six million borrowers in more than 52,000 villages (Small Loans, Strong Women). The Bank focused on lending only to the poor who had previously been denied access to credit as they "were considered high-risk borrowers, with a high likelihood of default." Loans of around $80 were given to people for income-generating activities and housing, without requiring any form of collateral or contract. Instead, the bank used a form of peer group pressure to help ensure that each person acts in a fiscally responsible way. Each borrower was required to be part of a five-person group with other people in the community who also desired loans. These borrower-groups capitalize on the idea of social capital and the notion that each of these poor communities had certain links, networks and modes of behavior that would encourage people to repay their loans. The loans were issued in sequence and generally repaid on a weekly or biweekly schedule. Interest rates were kept as low as possible while still assuring the sustainability of the bank. The Grameen Bank model has been replicated globally but incorporating adjustments to adapt to the local context. (FAO 2008-2020).

H3. Fisheries cooperatives

Human well-being: Low price of fish products/ High operating cost/Lack of access to resources or sense of ownership

What it is

A fishery cooperative is a group of fishers who act together to achieve some common business objective. This can be done informally or through a written agreement specifying the terms of cooperation. Hence, they are either (i) are voluntary organizations set up to serve and benefit those who are going to use them, or (ii) legal, institutionalized device that permits group action and competition within the framework of other types of business organization.

Purpose

To help fishers to have greater control over their products, to obtain a wide variety of services, and to have greater bargaining power than individual fishers would have. While fisheries cooperatives, associations and other organizational forms have an uneven record of success in developing countries, they can play such potentially beneficial roles as:

- increasing the resilience and stability of fishing communities;
- helping stabilize markets by managing supply;
- enhancing the negotiating position of fishers in relation to traders;
- improving product quality and value added;
- developing postharvest facilities and practices;
- improving logistics and access to market information; and
- managing risk through collective action.

How it works

There are several kinds of cooperatives classified according to the tasks performed:

1. Marketing cooperatives through which members sell their products.
2. Purchasing cooperatives through which members buy the inputs or supplies they need.
3. Service cooperatives that provide their members with improved services or with services they could not otherwise obtain, such as credit and insurance.
4. Processing cooperatives used for packing or processing the members' products.

Several factors are necessary for success:

- Will individual fishers make greater profits through the cooperative than if they remained independent?
- Are the interests of members similar enough for them to be able to work together?
- Can an adequate volume of business be secured and maintained?
- Can adequate and reasonable financing be secured?
- Is efficient management available and can the cooperative cover its cost?
- Is the membership prepared to meet competitive trouble?

If these questions can be answered positively, then the next steps include:

1. Having specific objectives stating exactly what the cooperative aims to achieve year by year.
2. Having a set of rules and responsibilities written down and understood by all members regarding, for instance, how profits will be divided, how much of production is to be sold to the cooperative, meeting standards for product quality, and how decisions to be made by members and staff.

Advantages

- Savings through economies of scale and size;
- Sharing of risks;
- Opportunities to increase bargaining power through better information, price and supply; and
- Can be engaged in participatory data collection

Disadvantages

- Developing joint responsibility means working with others to achieve the same objectives;
- Inefficient management resulting from either lack of experience or working with others;
- Inadequate membership support and relations;
- Lack of sufficient capital and financing; and

- Size and complexity of operations can result in a breakdown in direct membership control.

Examples of use

Countries around the world have different laws regarding cooperatives, and these laws should be examined and understood before developing a cooperative. Many countries throughout the world have fishery cooperatives and some also have overarching arrangements. For example, Fishery Cooperative Associations (FCAs) in Japan facilitates not only in resource management, but also addresses issues related to the low bargaining power of their fishers in markets. This also can be said for the fisheries marketing system in Norway that revolves around the operations of fish sales organizations, considered by fishers as their own means to mitigate risk and benefit from the market.

Not all fishery cooperatives are successful and some flourish before becoming dormant. In part, the success of a fishery cooperative lies with having strong leadership with strong advocacy skills and innovation to place them in a better position in the market place.

H4. Improving market access

Human well-being: Low price of fish products

What it is

Improving market access is a set of possible activities to reduce or remove conditions that limit fishers' market access, thereby increasing the ability of fishers to benefit from the social relationships and the institutions that control participation in trade.

Purpose

To increase opportunities for fisheries to generate greater income and to make fish available to consumers while enabling fishers to benefit from a marketing system.

How it works

International market access

- Create understanding of and compliance with seafood product standards and regulations for food safety in major importing countries and regions.
- Adhere to voluntary ecolabelling schemes and/or the development of national schemes, implementing tools that help reduce illegal, unreported and unregulated fishing. The may include port state measures agreements, catch documentation, records fishing vessels.
- Support to the implementation of traceability of capture fisheries products to combat IUU, but also to respond to the needs of food safety, CITES and ecolabelling.
- Support to high-level discussions on fisheries subsidies with an aim to reducing harmful subsidies.
- Reduce seafood fraud (when seafood is deliberately placed on the market, for financial gain, with the intention of deceiving the consumer).

Domestic market access (FAO 2020)

- Train fish technologists and processors in developing countries, to introduce appropriate technologies for reducing fish spoilage (especially for small-scale fisheries).
- Train fish processors in the fundamentals of quality, use of ice, hygiene, etc.;
- Improve handling practices (especially in small-scale fishing landing sites) and fish preservation methods.
- Improve fish consumption from low-value resources**.**

Activities for small-scale fishers (Jacinto and Pomeroy 2010)

- Stabilize fish supply;
- Organize groups for market development (e.g. fisheries cooperatives);
- Create a higher level of organization to increase market competitiveness;

- Strengthen trusting relations among different actors and create fisheries value chain networking;
- Improve infrastructure for a marketing system;
- Create a free flow of transparent market information between fishers and traders;
- Comply with food safety regulations and meet product and process standards; and
- Ensure access to credit for capital expenses and financing for fishing operations

Advantages

- Potential to earn higher per unit value; and
- Possibility to engage with actors who can facilitate access to financial resources, capacity building, and training as part of their investment in the value chain (FAO 2020).

Disadvantages

- Limiting factors may include:
    - availability of marketable fish;
    - inability to meet regulations and standards for products;
    - lack of low interest finance for investment and resources needed to access markets;
    - lack of knowledge and capacity to access or create markets; and
    - inability to establish and negotiate the terms of trade relations with traders and middlemen (Bush and Minh 2005; Zelasney et al. 2020). Markets could be at local, national, regional or global levels.
- Not all fishers are interested in the marketing aspects or doing business/trading/book keeping.
- Many fishers are paid a fixed sum and there is no incentives to receive increased prices.

- Requires building knowledge and skills, and attention to changes in market conditions.
- May require additional resources.

Example of use (Ayilu and Appiah 2020)

The Fishery Committee for the West Central Gulf of Guinea Fish Traders and Processors Network (FCWC FishNET) was formed with the goal of enhancing economic opportunities through trade and market-centered initiatives. It aims to create a unified platform for small-scale fisheries, with membership primarily comprising traders and processors at the national and regional levels. Credits through Village Savings and Loans Association mechanisms, along with trade networks and bulk transport, allowed the fish traders and processors to cover the cost of transportation for their catch to the market (which represents about a third of their total marketing costs), to improve access to markets, and to facilitate cross-border trade with higher profit margins. Access to technology and information, and trade networking also enabled fish traders to respond appropriately to price, demand, and supply dynamics as well as other market signals. Improved market-related infrastructure in fishing communities supports the small-scale fisheries post-harvest subsector in producing good quality, safe fish and fishery products, for both export and domestic markets, in a responsible and sustainable manner.

H5. Seafood direct marketing

Human well-being: Low price of fish products

What it is

Seafood direct marketing (SDM), also referred to as seafood alternative marketing, is a process involving fishermen selling seafood products to the final consumer or working via fewer intermediaries than in the dominant supply chain (Pomeroy et al 2020).

Purposes

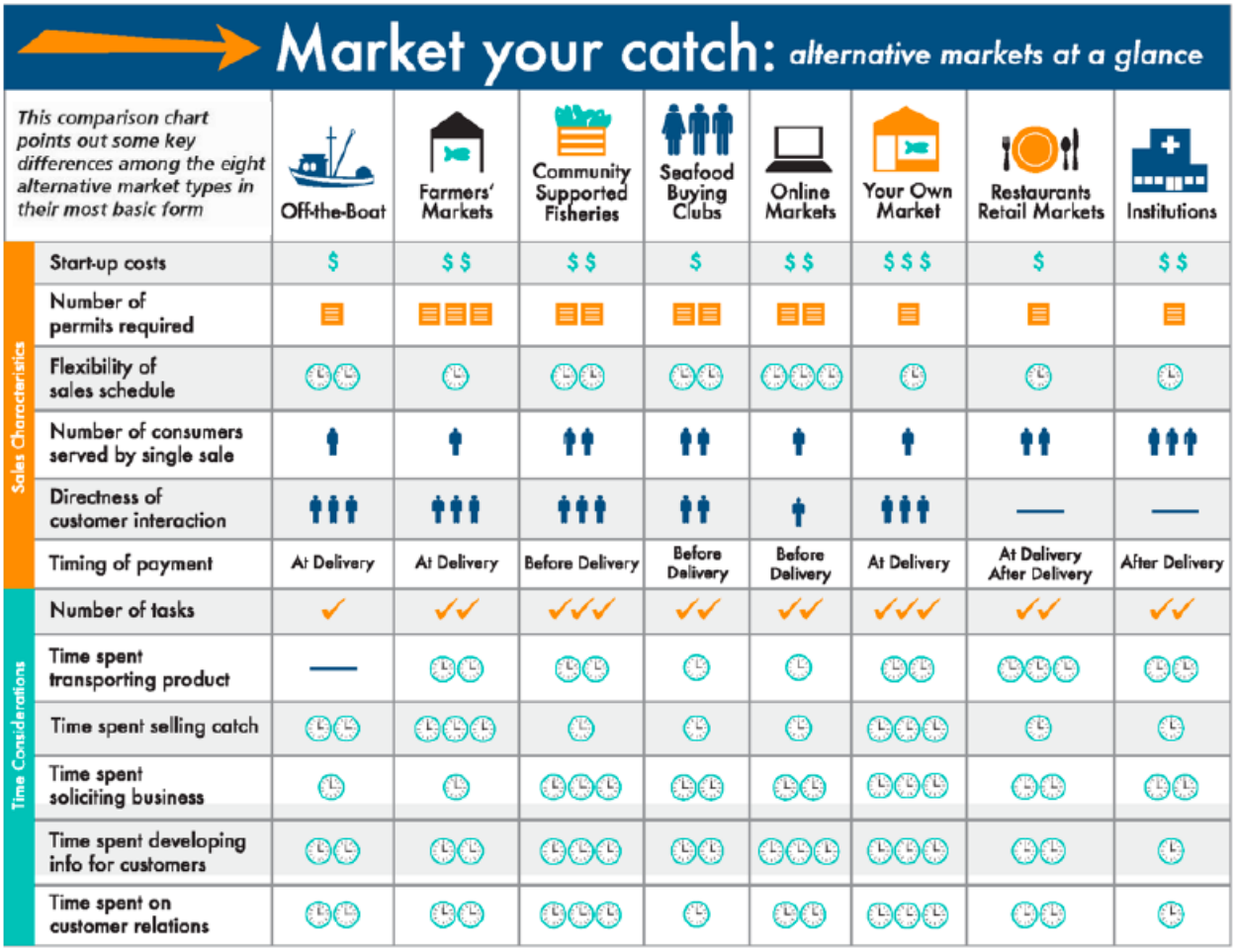
To increase fishers' incomes by providing outlets for lower-volume, higher-value (price-per-kilo) fisheries. This helps reduce vulnerability to the variability and uncertainty of pricing that often characterize long supply chains, especially those tied to global markets. SDM can also provide buyers with more direct access to fresh local products and enhance connections between fishermen and consumers (Pomeroy et al 2020).

How it works

Finding ways to launch an alternative seafood direct market requires guidance and support from those with experience and knowledge. Fishers should consult with those who have had the required knowledge, as well as with partners who can assist with the following steps.

1. The first step to is for fishers and their partners to conduct market research to identify interests for products, potential customers, and pricing practices.
2. The second step is to understand the options for business structures and the processes by means of which they are set up before deciding on the type of business and the market to focus on. These business structure options may include sole proprietorship, cooperative, partnership, cooperation, etc. Each type requires obtaining and maintaining specific permits and licenses. It also requires understanding different types of applicable taxes.
3. Financing the alternative SDM. This may include microfinance, fund raising, grant programs, no/low interest loan and investor programs.
4. Learning how to manage and minimize risks by oneself and/or through insurance.
5. Adhering to seafood safety practices throughout the supply/value chain process (Department of Health and Human Services 2020).
6. Promoting the products, e.g. through traditional promotional methods appropriate for the local context. Creating branding and labeling that identify and distinguish a product from others on the market. Consumers value food accountability and transparency of the supply chain. Therefore, a major selling point of local seafood is the knowledge of how, where and when a fish was caught, and by whom. Today, much of product promotion is done through social media networking.

Culver et al (2015) have highlighted eight types of SDM arrangements, which vary in terms of the business skills, time and resources required, types of products that can readily be sold, and other factors.



Advantages

- Diversifies ways to sell seafood as a complementary option to existing marketing arrangements;
- Fishers have higher chances of receiving fair prices and higher profit margins for their catch;
- Consumer are provided with locally sourced and fresher products;
- Increased consumers' knowledge of local products, such as how and where the fish was caught, handled, stored, and processed may raise the likelihood of both fishers and customers stewarding their marine resources; and
- Creates a direct connection between consumers and their seafood providers.

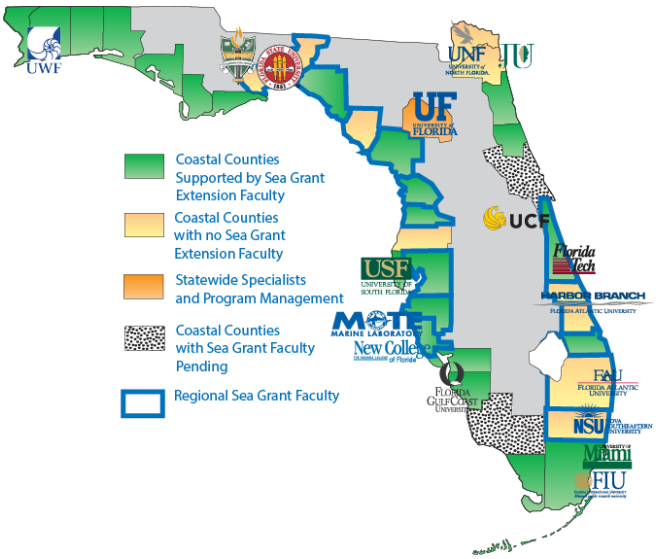
Disadvantages

- SDM is not for everyone. Not all fishers are or can be good business people; and

- More work for fishers as they need to develop a good business plan, secure the necessary business licenses, manage the finances and paperwork, advertise the project, and attract and retain customers.

Examples of use

In the West Coast of the USA, the Sea Grants programs have worked with fishing communities in Alaska and California to carefully consider SDM as a way to address regulatory, operational, environmental or economic challenges. Using a place-based SGEP models, they have assisted individuals and communities in building capacities to produce and market safe seafood products (Pomeroy et al 2020).



H6. Value-added production

Human well-being: Low quality of products/ Lack of skills/knowhow

What it is

Value-adding in fisheries production is broadly defined as post-harvest activities that increase the value of seafood products. It includes the knowledge, skills, and investment needed to create products (Bush and Minh 2005). The products may include dried, smoked, minced, breaded, pickled, and fermented products. The products undergo some level of processing that will inactivate and/or kill bacteria and pathogens. Value-added fisheries may also refer to social and environmental attributes beyond product quality and price, such as low environmental impact, fair trade, and humane treatment of the catch (Morrisey 2011).

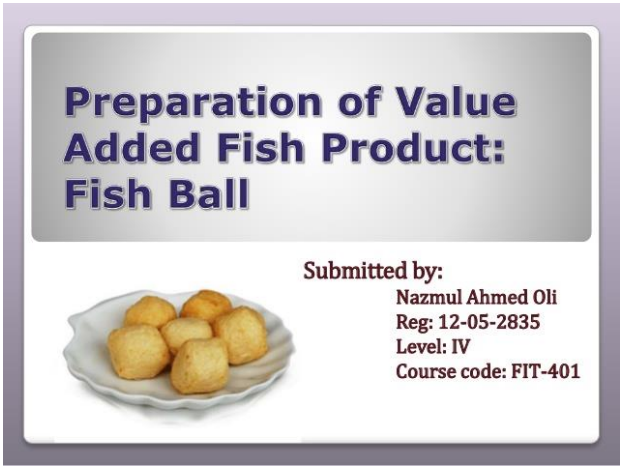
Purpose

To create and increase a new source of income, to provide new market opportunities, to reduce the amount of discarded seafood products, to preserve excess, to improve product safety, and to extend shelf-life.

How it works

Value addition could be market-driven, health driven, technology/infrastructure driven, or socially and environmentally driven. The process is to support fishers, especially small-scale fishers, to be able to:

- Develop skills and knowledge, including capacities for negotiating access, addressing social, cultural and political constraints, and marketing skills.
- Improve infrastructural facilities, including landing facilities, ice plant, etc.
- Invest in value added activities (both in handling, processing and marketing products).
- Create new markets, improve product distribution, or access high value retail markets.
- Improve physical and social infrastructure (e.g. cooperatives, collective community-based strategies).



Advantages (Morrisey 2011)

- Provides another level of safety;
- Increases shelf-life;
- Helps maintain a high level of quality, increasing market value which then returns more value to fishers;
- Opens new market opportunities to better meet changing consumer interests and requirements;
- Offers a solution for supply issues such as low value fishes and bycatch;
- Facilitates incorporating other ingredients for culinary benefits, quality and economy; and
- Promotes employment and entrepreneurial ventures.

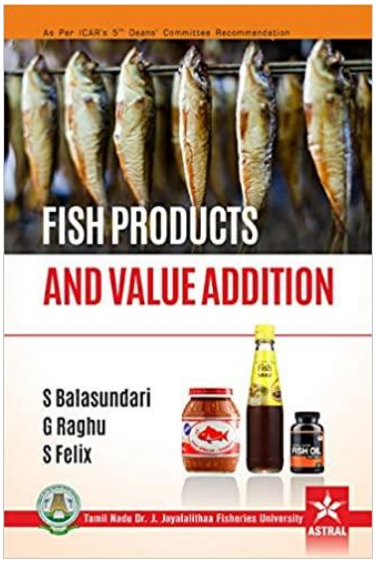
Disadvantages

- Need to meet the requirements of skills and technology for production; and
- Need for attractive packaging, marketing know-how, and safe storage.

Examples of use

The FAO-Thiaroye processing technique project in West Africa demonstrated a healthier and more efficient processing technique (FTT) improved smoked fish value chains. The technique produces products with an extended shelf life that meet international food safety standards, and helps reduce post-harvest losses during bumper harvests. This project met the challenges and took advantage of opportunities related to deploying the FTT. In particular, it explored the important and necessary role of the FTT in facilitating the social organization of fish processors, in improving gender equality and empowering women, and in supporting social organization and providing capacity development training in order to realize the benefits of improved infrastructure and overcome barriers to reaching new markets (Ford et al 2020).

In Tamil Nadu, India, a few self-help groups of fisherwomen were formed and conducted training on hygienic preprocessing of fish and the preparation of such value added items as shrimp idly powder, ready to cook fish, dried fish, and fish and shrimp pickles. The production of seafood value added items have helped to enhance the livelihood of fisherwomen (Selvaganapathy and Krishnan 2015).



H7. Fuel saving methods for small fishing vessels

Human well-being: High fuel cost/inefficient energy use

What it is

These are cost-reducing measures that do not involve major investments for small fishing vessels. The measures and practices focus on small fishing boats measuring up to 16 m (50 ft) in length and operating at speeds of less than 10 knots. The reason for emphasizing smaller boats is that the owners and operators of these boats have less access to assistance from naval architects, engine suppliers, and others than do owners and operators of larger boats. However, the main principles of fuel saving, such as reduced speed and the use of low engine rpm and large diameter propeller, are the same for large and small boats.

Purpose

To save fuel and reduce fuel costs. Fuel saving benefits fishers and consumers, while also helping mitigate climate change impacts.

How it works

There are a number of activities that can be used to save fuel:

1. Reduced speed.
2. Keep the boat bottom and propeller clean because hull fouling (with slime, seaweeds and barnacles) will slow down a boat and increase fuel consumption.
3. Use high gear reduction and an efficient propeller.
4. Service the engine regularly.
5. Carry out multiday fishing and mothership operations instead of going back and forth.
6. Changeover from a petrol outboard engine to a diesel engine. Although a diesel engine is much more costly to buy, it is less costly to operate, and the additional cost of a diesel engine installation would be repaid in a relatively short time.
7. Install the highest gear reduction available and a large diameter propeller with a propeller nozzle (depending on stern aperture).
8. Install advanced fish-finding equipment.
9. Use passive fishing methods (e.g. handline, bottom long line, drift longline, bottom set gillnet, drift gillnet) for which most fuel is used to travel to and from fishing grounds.

Advantages

Reduces the cost of fishing, which in turn improves profit margins and the returns from the fishing industry as a whole.

Disadvantages

Investments for equipment or change of engine are required.

Examples of use

In 1985, the project for Integrated Development of Artisanal Fisheries in West Africa (FAO/ DANIDA/NORWAY) conducted a trial for engine efficiency with a Ghana canoe measuring 14 m (46 ft) in length and having a load displacement of 3.1 tonnes. The canoe was fitted with a 35 hp outboard engine and later converted to a diesel engine installation of the liftable propeller and rudder type, with a fixed engine and a liftable propeller and rudder.
The diesel engine developed a maximum 23 hp at 3 000 rpm with a 3:1 reduction to the propeller shaft.

At a speed of 8 knots, the diesel engine installation had a fuel consumption of 3 liters per hour and the outboard engine had a fuel consumption of 8 liters per hour. The diesel engine installation had a fuel savings of 62% over the outboard engine. The saving was due in part to the lower fuel consumption of a diesel engine versus a 2-stroke outboard engine running on petrol. It was also due to the improved propeller efficiency of the slower turning propeller of the diesel engine, which ran at 930 rpm versus 1 750 rpm for the outboard engine.

H8. Fuel saving for large vessels

Human well-being: High operating costs

What it is

Innovations and transitions to reduce greenhouse gas emissions and provide more efficient and fishing vessels and operations.

Purpose

To reduce greenhouse gas emissions and the cost of fishing.

How it works

In general, fisheries operations are not a major source of greenhouse gas emissions. Nevertheless, there are smart business reasons to be more energy and fuel efficient and therefore participate in reducing the world's greenhouse gas pollution. Certain fishing activities rely upon and use a lot of fossil fuel, for example, fuel costs in some large-scale commercial fisheries can be 40 per cent of all input costs, so there is a large incentive to transition to systems that use less fuel.

Most fishing vessels use diesel fuel, but skippers can directly reduce a vessel's carbon footprint by reducing fuel consumption. There are a number of ways that this might be achieved:

- Using fuel efficient modern diesel engines;
- minimizing the drag of trawl gear;
- use of fuel flow meters to determine optimal operating speeds;
- engine and hull maintenance;
- efficient hull designs;
- optimizing engine and propulsion systems; and
- Shifting to low fuel (passive) fishing techniques such as static gear or seine netting.

Other options outside of reducing diesel consumption include:

- Use alternative fuels such as hydrogen, liquefied natural gas, wind power (sails), biofuels and solar energy. The oxides of sulphur emissions from Biodiesel are at least 80% lower than low sulphur fossil diesel.

Advantages

Lowering the carbon footprint of a fishing vessel reduces costs and reduces the greenhouse gas emissions. With fuel costs being a significant contribution to the cost of fishing, any gain in reducing fuel consumption is important.

Disadvantages

Higher purchase prices of alternatively powered vessels, may disadvantage smaller operators, e.g. family-owned fishing vessels, who cannot afford the up-front costs.

Examples of use

Most fishing vessels in use today are based on aging technology. This is especially the case in developing countries where fishing vessel design and construction has not changed for decades. Fishing vessels are still built with traditional materials (e.g. wooden hulls) with inefficient diesel engines. These vessels are built to travel huge distances from their home ports to chase the declining supply of fish, and, therefore, are outfitted to spend considerable time at sea, often with large crew quarters. Very little consideration is given to more modern technologies that can reduce fuel consumption and make fishing more profitable.

Modern technologies for fishing vessels are being developed in a number of countries. Hydrogen powered fishing vessels are being built in Europe and Japan. Many countries are adopting newer technologies such as propeller nozzles (e.g. fixed pitch propellers) to improve pull values and fuel consumption.

Other innovation range using the ocean's natural waves as an energy source using docked fishing vessels in Norway, to fishing boat that can be configured to efficiently work different types of fishing gear using diesel-electric drive system that produces electricity to power an electric engine in Australia.

H9: Human rights-based fishery management

Governance: Weak compliance

Human well-being: Lack of access to resources of or of sense of ownership/Conflict among sub-sectors

What it is

Human rights establish a universal foundation for human dignity. These include political, economic and cultural rights, such as the right to freedom of expression, the right to protection, the right to livelihood, the right to a fair trial, and the right to education. Generally, human rights recognize the inherent value of each person, regardless of background, residency or system of belief, and are based upon the principles of dignity, equality, and mutual respect. In a fisheries context, human rights include poverty reduction, equitable resource allocation, social safeguarding, participation in decision making, and access to healthcare, education, and other community infrastructure and services.

Purpose

Human rights can be integrated as part of an expanded "rights-based approach" to fisheries management (see below for definitions of different rights). Adding human rights addresses fundamental issues that may hinder successful rights-based fisheries governance aimed at helping small-scale fisheries to fish responsibly and contribute to reducing poverty.

How it works

As well as human rights, there are two other main types of rights:

1. *Property rights* refers to who owns the fish. In general, in modern day marine fisheries, the fish are owned by the people of that country and managed on their behalf by the government.
2. *Access or use rights* allow holders of the right to take part in a limited entry fishery or to fish in a particular fishing ground (note: open access refers to the situation where everybody is allowed to fish). Examples of access rights include fishing licenses/permits, Territorial Use Rights (TURFs) (see related factsheet) and Customary Marine Tenure (CMT) where near-shore areas are owned by clans or larger communal groups, and are therefore not open access fisheries. Use rights are normally governed by numerical limits on resource usage, whether in terms of specific inputs or the amount of fishing effort allowed (e.g. Total allowable effort (TAE) and quotas (IEQs and ITEQs) or specific catch limits (Total Allowable Catch (TAC) and quota (IQs and ITQs) (see separate fact sheets).

Advantages

- The human rights framework provides a means of acknowledging and addressing the social dimensions of complex fisheries systems.
- Linking human rights to fisheries governance also provides a vehicle for increasing the accountability of government organizations to their citizens, and consequently, the likelihood that policy measures will be implemented in practice.
- A human-rights-based approach allows the fisheries agency and fishing communities to develop links that strengthen fishery governance and address poverty reduction. These may include partnerships with emerging grassroots democratic processes, and new alliances of power between, for example, environmental NGOs and local communities. In many cases, it is the NGO and civil society sector – development NGOs, advocacy NGOs and grassroots movements – that are taking the lead in advocating and strengthening human rights for fishers and other households engaged in the sector.
- This tool takes existing traditional user rights into consideration and builds on it to better meet the needs of fisheries management.
- Prevents the open-for-all situation where everyone races for the fish, depletes the stock, and degrades the environment and the prospects for fisheries resource sustainability.
- Secure access rights of certain fisher groups to fisheries resources.
- Moves fisherfolk from a position of isolation to contributing to improvements in fisheries management, governance and their livelihoods.

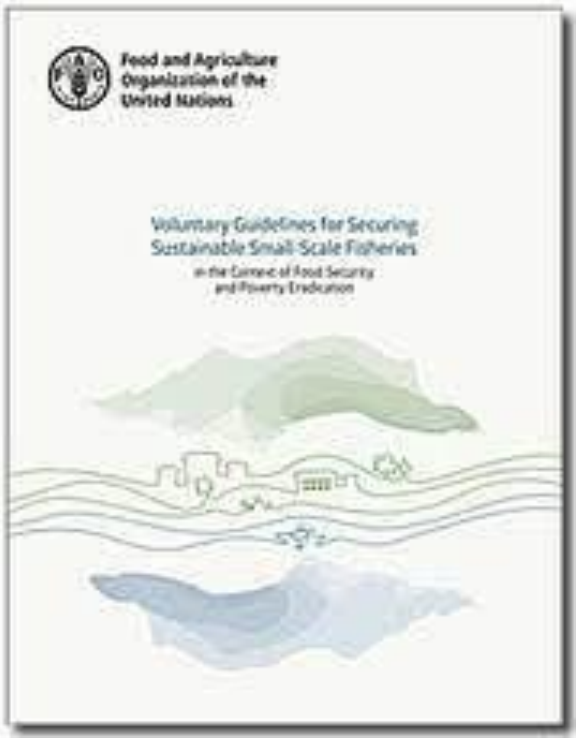
Disadvantages

- Conflict is inherent to any rights-based system since some people are excluded and some may enjoy more rights than others.

- Linking human rights to other rights-based systems brings with it the disadvantages outlined in earlier right-based tolls. These included:
    - Defining who can and cannot take part in the fishery and changing existing use rights can be controversial and sensitive, and must incorporate comparisons of different options in response to the local context. Decisions involving use rights can also affect, not only current fishers, but also other groups.
    - The task of introducing, or reinforcing, a use rights system (or changing the distribution/functioning of rights within an existing system) requires considerable care, with no simple 'cook-book' formulas to help. Use rights need to be appropriate to the cultural and historical situation. Use rights must be supported by policy measures aimed at maintaining or restoring the rights systems. It also places demands on the financial and personnel capacities within the particular fishery.
    - Once a set of use rights is implemented, it may be very difficult to make major changes. When a status quo set of use rights comes to be seen as inappropriate, clear policy directions and much effort are needed to change it.

Examples of use

The FAO introduction of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (the "SSF Guidelines") in 2014 draws on human rights standards as its guiding precepts. The SSF guidelines have helped translate human rights principles into action as a crucial step toward ensuring the basic dignity of fishery-dependent people around the world and promoting their empowerment to achieve sustainable and equitable fishing livelihoods.



H10. Gender mainstreaming

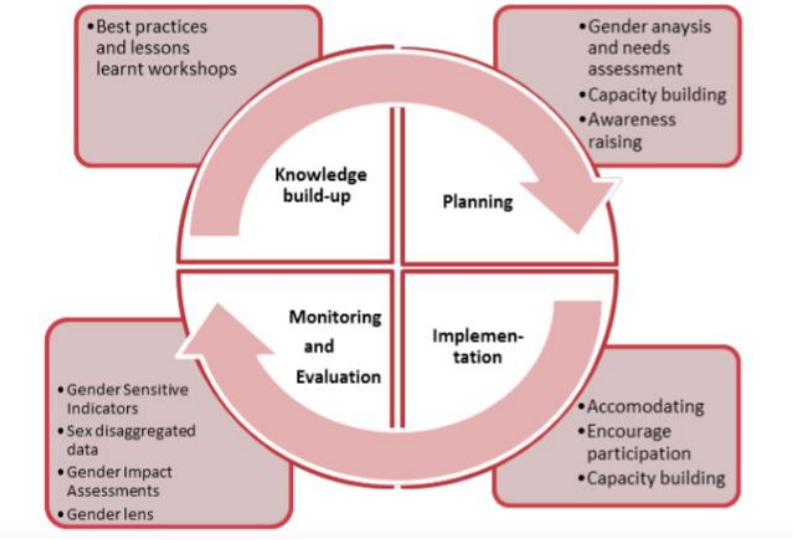
Human well-being: Lack of access to resources or sense of ownership

What it is

Gender mainstreaming is the process of assessing how women and men are (often differently) affected by fisheries planned actions—including legislation, policies and programs, in all areas and at all levels—and ensuring that their roles, responsibilities, concerns, attitudes, and experiences are considered to be integral dimensions of these actions (adapted from FAO 2013).

Purpose

To ensure equitable benefit distribution and sustainable human development for all in the fisheries sector. To reduce the vulnerability of women in the fish value chain in which both men and women have important roles to play in terms of more responsible fisheries practices and sustainable development.



The main steps of gender mainstreaming are shown in the diagram (Torell, Owusu, and Okyere Nyako 2016).

How it works (FAO 2013, RFLP 2013)

- Firstly, improve the gender awareness and mainstreaming capacity of senior managers and policy makers in fisheries and aquaculture.
- In fisheries research, monitoring and evaluation, increase attention to gender-related data and knowledge gaps from fisheries and aquaculture.

- In implementation, bridge the gap between the relatively strong attention given to gender in policy responses and the much weaker integration of gender analysis and perspectives in implementation processes. Carry out gender analysis as soon as possible and strengthen the focus on gender equality.
- In communications, develop and disseminate gender mainstreaming communications materials. Create opportunities for regular sharing of information on gender activities.
- Pursue compliance and tracking of the Fisheries Department's contributions to achieving gender equality objectives.
- Establish a gender network, linking and being a part of other gender mainstreaming initiatives. Exchange lessons and learning.

Advantages

- Supports human rights and sustainable development goals;
- Improves coastal fisheries and food security; and
- Increases community well-being and social cohesion in fishing communities, reducing conflicts and making community less vulnerable.

Disadvantages

It takes understanding and recognizing women's contribution to fisheries, as well as appreciation of the importance of gender analysis and gender mainstreaming at all levels, to overcome the lack of capacity for truly integrating gender into fisheries governance, research, and development projects. While there have been recent commitments and attention to gender mainstreaming in international, regional and national policies, gender-aware and gender sensitive fisheries development policies and practices are still relatively recent and outside support for them is necessary.

Examples of use

Given the prominent role of women in the post-harvest segment of the flyingfish value chain in Barbados, the collective action of the women-led Central Fish Processors Association (CFPA) was formed and developed. It has provided benefits to its members in terms of their livelihoods and domestic lives, as well as to the flyingfish fishery more generally. The example highlights valuable lessons to inform others in fisheries post-harvest organizations (Pena et al 2020).

In Sri Lanka, the inclusion of women representatives has been made compulsory in co-management coordination committees established with the support of the Regional Fisheries Livelihood Program for South and Southeast Asia (RFLP). In addition, a minimum of two women directors must sit on the board of the RFLP- established Fish Finance Network Association. Meanwhile, in the Philippines, RFLP is promoting the allocation of at least 30 percent of seats on Fisheries and Aquatic Resources Management Committees for women. During 2011, RFLP carried out a gender analysis in the Negombo area of Sri Lanka aimed at understanding gender differences in the division of labor at household and community level; analyzing the level of access to and control over resources; and identifying levels of mobility. Adjustments were subsequently made to RFLP activities taking into account the results of the analysis (RFLP 2013).

H11. Communication and outreach

Governance: Weak compliance

Human well-being: Lack or limited alternatives for sustainable livelihoods

What it is

Activities that communicate, impart or exchange information that is useful and important for ecosystem approaches to fisheries management. It helps fisheries and stakeholders to become aware of policies, rules and regulations that are in many cases fundamental for behavioral change, providing them with useful understandings of habitats and resources, as well as information related to livelihood opportunities and safety.

Purpose

To create, build, and correct understandings of issues and knowledge to achieve the objectives of ecosystem approaches to fisheries management. Outreach and communication can increase community engagement in different programs and management, create better relationships among management and stakeholder groups, and support enforcement and compliance.

How it works

Distributing information to all stakeholders on zoning, regulations, restrictions, fines, livelihood programs, management body, etc. This can be done through the most appropriate forms of communications for target audiences. These could be radio or TV announcements, simple fact sheets, posters, town meetings, or webinars. Bulletin boards can be placed near key ports and fishing cooperatives to broadcast regulations, and pamphlets can be provided at airports and tourism kiosks. Outreach can also be targeted to local primary and secondary schools with exhibits, videos, and informal discussions. Branded merchandise such as T-shirts, ball caps, and bracelets is often popular and, embellished with appropriate messages, can be distributed to increase awareness.

Advantages

- Fosters community buy-in and participation;
- Increases compliance; and
- Fosters positive relationships between officials and fishers, and among stakeholder groups

Disadvantages

- It requires upfront investment in resources, including equipment and technology for campaigns, communications products, and maintenance of equipment

Examples of use

The U.S. Fish and Wildlife Service emphasizes the importance of effective outreach because it helps the agency build trust and gain assistance from the public, making sure that the Service and its scientific ways of working are well understood. It also provides a mechanism for listening to and understanding the public's concerns. The Service developed a handbook for outreach with key guidance, policies, and helpful tips to serve as a one-stop reference for enlisting the support of a wide range of the publics by improving communications with them (U.S. Fish & Wildlife Service).

The Fish Right project in the Philippines identifies and trains community outreach and peer educators (youth, women, fishers, etc.) to educate, motivate, plan and support their peers in conservation actions within their households and communities. The project uses social media to create public awareness and to alter behavior towards resource protection. They also collaborate with such private sector partners as supermarkets, national and multilateral government agencies, and conservation organizations to organize multi-partner alliances and communications campaigns (Coastal Resources Center 2018).

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Annex 1: Controlling fishing catch and fishing effort

Reference points for single species fisheries management

Although based on a very simplified model of a fishery, the static/equilibrium model is often used to explain how fishing effort affects the catch, revenue and costs of a single stock fishery (see figure below) and forms the basis of setting high level goals and objectives in fisheries.

Figure 1 represents a fishery operating on a single fish stock. Fishing revenue is the amount of money fishers make by selling their product (this can also be generalised for the value adding provided by later processing of the catch). Thus, the amount of fishery revenue at any point in time is the price times the total catch. The catch depends on the underlying population dynamics of the stock and the kind of gear deployed (e.g. the minimum length of fish caught). When graphed against the fishing effort the fishery revenue resembles an inverted parabola, with the peak at the maximum revenue that could ever be achieved.

For each level of fishing effort there is a total cost due to fixed and variable costs of fishing, shown here as a straight line. Fishing costs include variable costs, costs and crew payments. Variable costs (e.g. fuel, ice, bait, food) vary with fishing effort and commonly include items consumed during the fishing trips plus landing costs. Fixed costs fixed (e.g. vessel, rent and capital) are constant whatever the level of the fishing effort and mainly concern repairs, maintenance of fishing capacity and insurance premiums. Crew payments are salary costs, including wages and social payments (i.e. social security costs) for vessel masters and crew.

The rent is the net economic return to the fishery and is the difference between the fishing revenue and the total fishing costs. The rent is positive for low fishing effort and negative for high fishing effort, with the point where the total cost crosses the revue being the point zero rent from the fishery (costs = revenues).

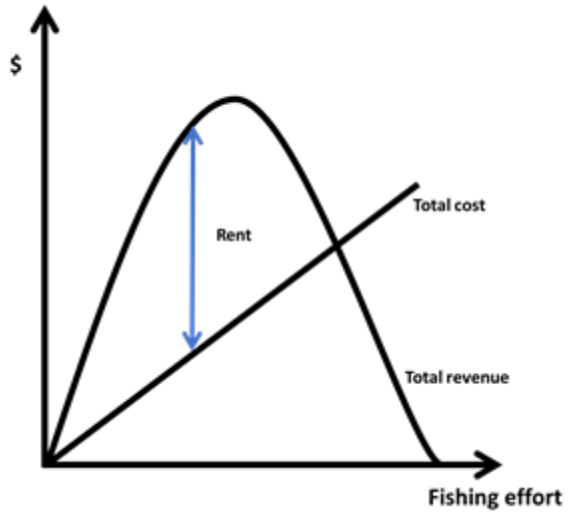

Figure 1: The static/equilibrium model of fishing values ($) and fishing effort for a fishery on a single stock.

Maximum sustainable yield (MSY), maximum economic yield (MEY) and open access

When a fishery is unregulated, and for example, left open to anyone who wants to fish, then fishing effort will increase as long as there is a positive rent available from the extra effort. This increase in unregulated effort is predicted to end when the rent from the current effort is zero. At this point all the rent has been dissipated, both for the existing fishers and any prospective new fishers (see Gordon, 1954). Experience in many parts of the world has shown that unconstrained or poorly constrained fishing effort continues to increase to the point where the revenue equals the total cost (Garcia et al., 2008; Lleonart and Merino, 2010; Pomeroy and Andrews, 2011; FAO, 2015; World Bank, 2017). This is known as the "open access" equilibrium point and is regarded as a very non-optimal outcome for fisheries because all the potential rent is dissipated into meeting fishing costs.

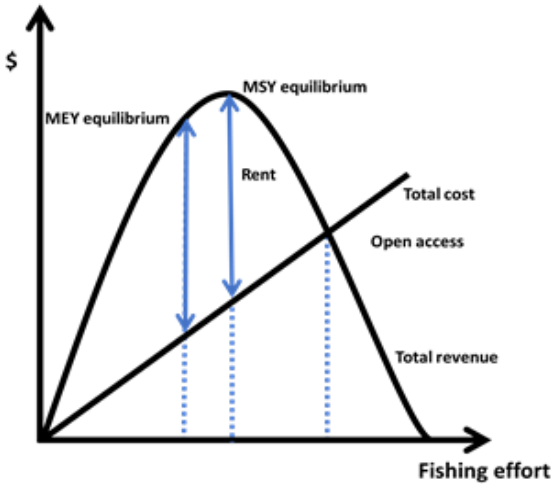

Figure 2: Three common reference points in a single stock static/equilibrium model. These are (1) the Maximum Economic Yield that maximises rent, (2) the Maximum Sustainable Yield that maximises gross fishery revenue, and (3) the open access equilibrium where costs equal gross fishery revenue and rent is zero.

The open access equilibrium achieves zero net economic benefits for the catching sector and is also very risky in terms of the sustainable use of the stock. The participants in an open access fishery will have employment but overall, there is low fishery yield in weight or total economic value, the fishers have very close to no profitability, there is little except economics to prevent further fishers from joining the fishery thus making the situation worse. The resource becomes depleted so that fishery or ecosystem collapse becomes more likely.

Alternatively, fishery managers may want to maximize both the gross level of revenue from the fishery and the amount of food produced, so they may set the level of effort that aligns with the peak of the revenue curve (ie the maximum sustainable yield or MSY). MSY is generally defined as the highest theoretical equilibrium yield (catch) that can be continuously taken on average from a stock under existing average environmental conditions without significantly affecting the reproduction process of the resource.

Changing the fishery from open access to maximum sustainable yield requires a reduction in fishing effort, so that the fish stock is able to recover and produce more.

Similarly, fishery managers may want to maximize the total rents generated by the fishery and so may set the level of effort that aligns with the maximum sustainable yield at the maximum economic yield (MEY). The MEY is the sustainable harvest level that maximizes total rents from fishing, and achieving it requires this level to be calculated and implemented. An important point to highlight is that to achieve the MEY the fishing effort has to be reduced even further than the point of maximum sustainable yield and so it is more risk averse than the MSY both economically and ecologically.

Maximum social yield (MScY) and social open access

MSY and MEY assume that the costs associated with fishing effort completely capture all the relevant cost that society incurs when exploiting a fishery (ie, capital investment, permits, fuel expenses and wages). This assumption will not be true, however, when fishing wages do not reflect the real opportunity cost of labour. This is the case, when there are high levels of unemployment and fishing is the main source of income. When fishers face those circumstances, their opportunity cost falls to levels close to zero as they have no other opportunities available for them in terms of labour occupation (Panayotou, 1982).

Under such conditions, the static/equilibrium model can be used by removing the wages (opportunity cost of fishing) from the cost per unit of effort (Figure 3).

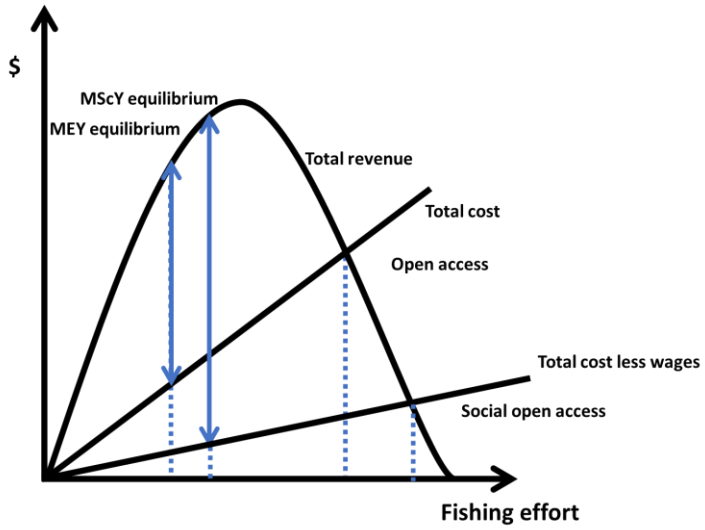

Figure 3: Social benefits with respect to the reference points in the static model for fisheries. MScY is the maximum social yield.

We can see that maximum social benefits will require higher levels of fishing effort than the point of maximum economic yield. Moreover, if the fishery were to be run based on these

adjusted costs, the equilibrium level of effort will be greater than the one achieved at the point of zero profits. In addition, note how the increase in effort reduces the profits from MEY to MSU, to be completely dissipated at open access. Total wages, on the other hand, are not dissipated until reaching the extreme point of the social open access, where the fishery is so impoverished that the activity can only cover the operational costs. Finally, it is important to keep in mind that even when net benefit of society is being maximized, effort levels are higher than MEY, although still lower than MSU.

Reference points for multi-species/multi-gear fisheries management

In the case of multi-species/multi-gear reference points the basic model is the same as for single species, but with different production (or revenue) relationships for the different species/groups and different cost relationships for the different fishery gears. Figure 4 shows three revenue curves of three stocks and two cost relationships for two different types of gear. The first revenue curve (stock 1) is for a less abundant, slow growing, lower productivity stock, such as a grouper (orange curve). The second revenue curve (stock 2) is for a more productive and abundant stock, such as a threadfin bream (green curve) while the third curve (stock 3) is for a very productive, short-lived stock such as a pony fish (blue curve). In this scenario, the price that the fisher receives for the three stocks is similar, although this is not the case in the real world and can be accounted for as required (see below). The cost line for a lower-cost gear (eg beam trawl) is shown in red, while the cost line for a higher-cost gear (eg pair trawl) is shown in brown.

If we consider the less productive stock (stock 1) the MSY_1 is achieved at a relatively low level of fishing effort compared to the other fish types and the open access point is also reached at a relatively low fishing effort, especially for the case where the fishing costs are higher (eg pair trawls). The stock that represents an intermediate productivity (stock 2) has a MSY_2 at a fishing effort that is higher than that giving MSY of stock 1, and in this model MSY_2 is about equal to the open access point for stock 1 for beam trawls (OA_{11}) and higher than the open access point for pair trawls (OA_{12}).

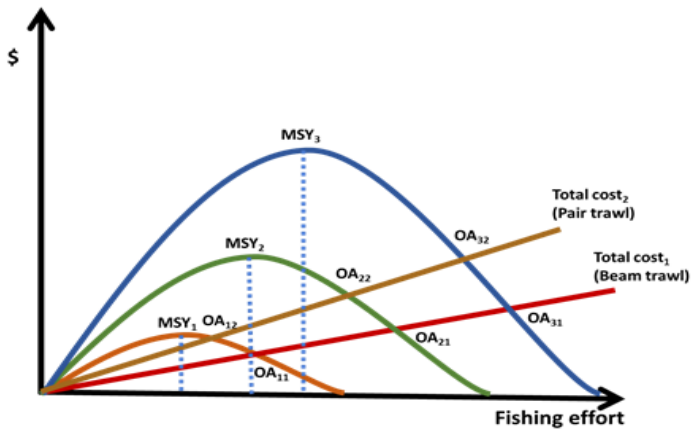

Figure 4: Reference points in a multi-species/multi-gear static/equilibrium model with all stocks having the same price /kg for the fish. This is Scenario 1.

Thus, fishing with an effort giving for MSY_2 produces no rent from stock 1. For stock 3, where the fishing effort giving MSY_3 is even larger, there is still rent returned from stock 2, but stock 1 is fished well past the open access point for pair trawls (OA_{12}). Thus, although fishing at MSY_3 would produce the highest overall revenue when taking all the stocks into account, the strategy is very risky for the low productivity stocks.

A more likely scenario (Figure 5) is where the price of the less productive stock is higher than the price of the more productive stocks but because of low catches, the maximum revenue from this stock is low. For the highly productive stock, the catch is high but the price is very low, so the maximum revenue from this stock is also relatively low (higher than stock 1). Stock 2 has a medium productivity and a medium price and it will produce higher maximum revenues.

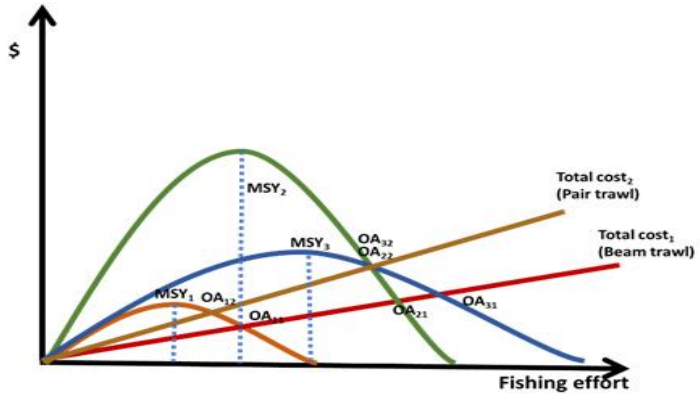

Figure 5: Reference points in a multi-species/multi-gear static/equilibrium model in which a stock that produces a medium catch at medium price/kg results in the highest maximum revenue at MSY_2. The catch of a less productive stock (brown line) may have a higher price but the total revenue from this stock is limited by its low productivity. The catch of a more productive stock (blue line) may have a higher catch but the total revenue from this stock is limited by its low price. This is Scenario 2

In this case, fishing at MSY_2 would generate the most revenue for the fishery as a whole. However, as in the previous scenario, fishing for MSY_2 would be at the open access point for beam trawls and above the open access point for pair trawls for stock 1, although it is not nearly as risky as fishing at MSY_3 in scenario 1. Fishing at MSY_3, however, would not generate maximum revenues or rents and would be very risky for stock 1 (ie past the point where recruitment could be impaired).

Note that in both these plots the peak of each species is in a different spot. With this combination of gears, it is not possible to be at the peak of the grouper (orange curve), threadfin bream stock (green curve) and pony fish (blue curve) production curves for any level of effort. That is, it is simply not possible for all species to be at MSY at the same time. This is why just adding the peak point of all three individual curves (ie the individual MSYs) to get total M MSY is an error and this gives a drastic overestimate of the possible maximum yield. A more appropriate approach to estimate the MMSY is to add, for each level of effort, the catch or revenue from each species so as to produce a relationship between the combined catch available for a given fishing effort.

These bio-economic models may help conceptualise some basic concepts, but they are obviously gross over-simplifications of real fisheries. In real multi-species/multi-gear fisheries there can be hundreds of stocks, more than two types of gear, variable product prices, and change through time of any of these fishery components. And specifically, the model assumes equilibrium where there has been no change in the environment and no change in the ecosystem structure. This is obviously not the case (see later sections).

However, the model and scenarios are informative in looking at how changes in the relative productivity of the stocks, the type of gear used and the price the fisher receives for his/her fish influences the "optimal fishing effort". If a social objective was added, such as maximising employment, this has the effect of forcing the fishing effort higher for all stocks, possibly past the point of the open access equilibrium in many cases. Also, in the real-world, policy has to consider the benefits accrued to everyone associated with fishing, especially those involved in adding value along the supply chain, including those employed in processing and manufacture of fish products.

Setting decision rules (harvest control rules)

Decision rules, also known as harvest control rules (HCRs) identify pre-agreed management actions that depend on stock status, and other economic or environmental conditions, relative to reference points. Specifically, HCRs:

- Formulate a procedure for making harvest decisions, such as converting the outcomes from a stock assessment or monitoring into management actions to achieve the desired state.
- Ideally give pre-agreed harvest rules allow managers to quickly act when the state of the fishery degrades beyond acceptable limits (eg near the limit reference point). Without explicit rules to govern harvest levels, there is a tendency for exploitation rates to move towards levels that maximize short-term gains rather than to achieve long-term objectives (eg, stable yields, maximizing catch rates, maintaining sufficient reproductive capacity, or preventing overfishing).
- Should be developed with the involvement of all stakeholders.
- Candidate HCRs should be tested for robustness to uncertainties in monitoring and estimates of fishery status, environmental conditions, harvester behaviour, and managers' ability to change harvest levels (FAO, 1995).
- The rules should be precautionary if the HCRs are based on very uncertain information. Conversely, they can be less precautionary if based on more certain information.
- The rules should be periodically reviewed to ensure that management objectives are being met and as necessary to allow adaptive changes.

There is a wide range of fishery management controls used in Southeast Asian fisheries and other multi-species fisheries, including the registration of fishers and/or their vessels,

specifying the effort by gear type, setting open/closed areas or seasons, setting minimum legal size and defining acceptable gear type requirements. While these various kinds of harvest controls are in common use, they have mostly evolved through reactive fishery management processes over many years. Usually these management controls have not been developed and tested as an integrated part of fishery management assessment.

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Annex 2: Monitoring, Control and Surveillance (MCS)

There is a number of schemes that different organizations and countries use to categorize the different compliance and enforcement activities. One widely accepted framework is known as monitoring, control and surveillance (MCS). Another one, common in Europe, is known as control and inspection (CI). Effectively, these are just different ways to group the same sort of activities, but because the same word (e.g. control) can have different meaning in different frameworks, it can be confusing.

In this manual, we will use the MCS framework promoted by the FAO (see box for the definitions).

The objective of MCS is to contribute towards good fishery management through ensuring that appropriate controls are set, monitored and complied with.

In the past, MCS has usually developed through the implementation of centrally developed fisheries policies and management strategies. The connection to the coast guards or the Navy has reinforced this top-down perception. However, MCS is increasingly evolving to a much more participatory process that embraces both large-scale and small-scale fisheries and is becoming a bottom-up process.

MCS is the acronym for:

- **Monitoring (M)** – the collection and analysis of information relevant to setting controls and monitoring compliance
- **Control (C)** – the regulations and rules by which the fishery is governed
- **Surveillance (S)** – observing and policing to ensure compliance with the fishing rules

The need for formal MCS systems resulted from the adoption of UNCLOS and the establishment EEZs. Before this, fishing activities within the territorial seas could be viewed from the shore, and MCS requirements were often simplified to a code of behaviour that existed within an informal management system. The MCS systems that followed UNCLOS were developed to ensure that control measures were adequately implemented and that fishing took place within the legal framework set up to manage the fishery. This is still a core function of MCS systems, but due to a more integrated approach to fishery management, a far wider and more holistic role for MCS has emerged.

MCS strategies now focus more strongly on integration within the overall fishery management system, promotion of compliance by fishers through user participation, and working globally and regionally to combat IUU.

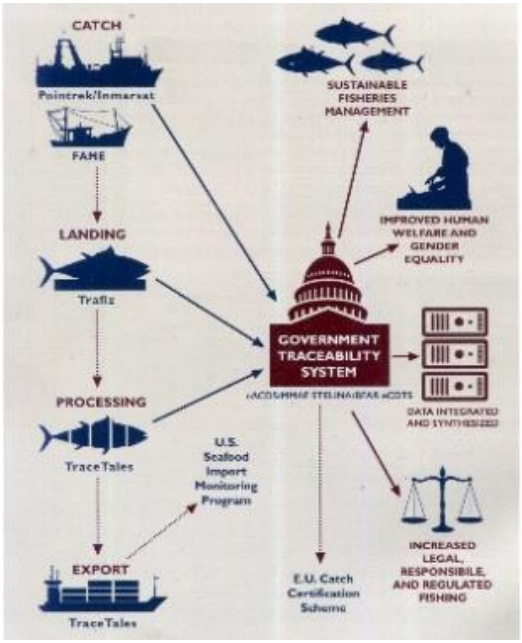
M - Monitoring

Monitoring for MCS as defined by FAO (2009) is the continuous requirement for the measurement of fishing effort characteristics and resource yields (Figure A3.1). More specifically, it covered the monitoring of:

- Catch
- Species composition
- Fishing effort
- Bycatch (i.e., species other than the target species incidentally captured by the primary effort)
- Area of operations

More recently, it has been recognized that monitoring for MCS should also focus on monitoring activities that inform compliance and enforcement, such as:

- Catch documentation and traceability
- Vessel characteristics and gear
- Illegal actions and arrests
- Crew characteristics



The first group of monitoring items are used to set controls, while the second group are used to help ensure compliance with those controls.

C - Control

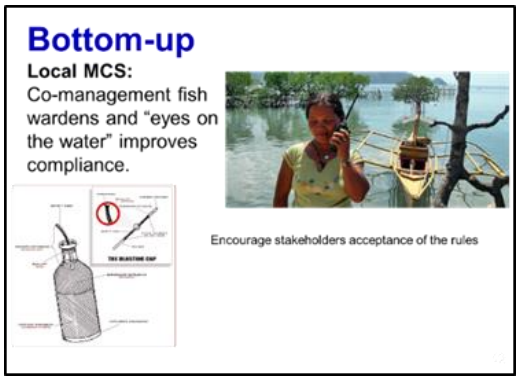
There are many management measures that can be used to control fishing operations. Separate fact sheets are provided for these measures in the Ecological and Human well-being sections.

- Technical measures (e.g. control on gear type, time and place of fishing and size of fish caught)
- Input controls (e.g. limiting the number of boats and gears, limiting fishing days, limiting access to certain areas based on the total allowable effort (TAE))

- Output controls (e.g. total allowable catch (TAC) and individual quotas (IQ)
- Market controls (e.g. ecolabeling and certification)
- Broader ecosystem measures (e.g. habitat restoration, bycatch reduction devices (BRDs), alternative livelihoods)

S - Surveillance

Surveillance covers all the activities that can be used to detect IUU activities, both on land and at sea. Enforcement to make sure that people obey the law or rule is often linked to surveillance. Surveillance and enforcement can be "bottom-up" (i.e. carried out by stakeholders through co-management) and/or "top-down" (i.e. carried out by government officials) (Figure A3.2). While the national and local governments have responsibility for law enforcement, enforcement of regulations by fishers is becoming increasingly common, especially in small-scale fisheries. In some cases, fishers are deputized to undertake enforcement, while in other cases they can only report illegal activities. Resource users may also decide to self-enforce regulations when they believe that they benefit sufficiently from compliance with regulations.



Annex 3: Participatory planning and implementation of fisheries management: co-management

Background

Participatory planning and implementation of fisheries management that engages key stakeholders in all phases of the fisheries management cycle, starting from sharing an agreed vision through to monitoring and evaluation (M&E) of progress. Real participation (not just top-down "consultation") involves negation and reaching consensus on the many areas of conflict that will arise in fisheries management.

Participation

In the ecosystem approach to fisheries management 9EAFM), both the resource users and the government (whether local, provincial, national or regional) share the responsibility and authority for managing and determining the sustainability goals of the fishery (co-management). The stakeholder engagement activities build institutional knowledge of the EAFM team, key stakeholders and participating partners, agencies and institutions.

The benefits of broad participation include:

- Agreeing on issues and solutions – consensus;
- Identifying trade-offs;
- Promoting empowerment;
- Awareness raising;
- Promoting ownership; and
- Fostering group trust.

It is also very important to identify champions or leaders who will provide the drive to follow through with the process and motivate others.

The three pillars of participatory approaches are:

- *Attitude and behaviour*: the facilitator's attitude and behaviour are critical to the success of participatory workshops. He or she has to remain neutral, manage discussions fairly and involve all those present.
- *Tools*: there are various tools that can be used to elicit participation from all members of the population.
- *Sharing*: sharing information, knowledge, opinions and feelings is a key element of participatory processes. Through this sharing, people are empowered and issues can be discussed and resolved, or at least brought into the open, where they can then be managed through conflict resolution.

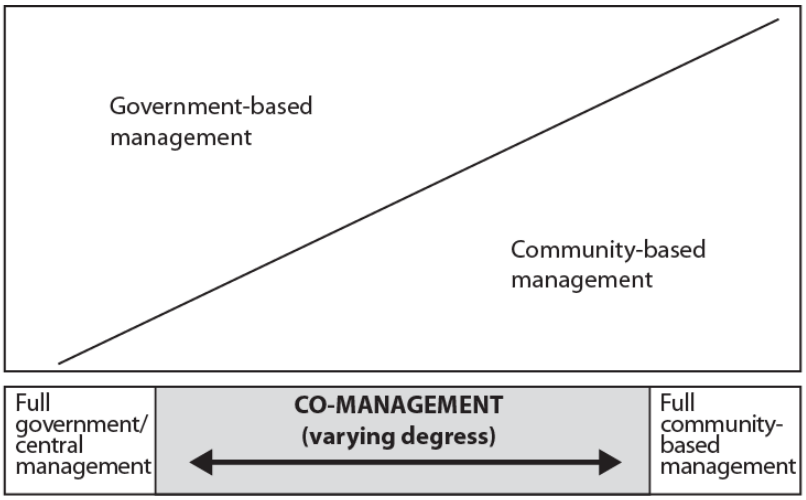
An important aim of the participatory approach is to empower people and groups who are most vulnerable and less able to ensure their needs and expertise are represented in decision-making. For the EAFM process to succeed, men and women resource users, local organizations and communities, as well as local government officials and other stakeholders need to be enabled to take control and make decisions. To do this they will need to increase their awareness and understanding of fisheries resources and their management in an ecosystem context.

The benefits of such empowerment include:

- increased awareness, knowledge, skills, institutional capacity;
- ownership of decisions and outcomes;
- responsibility;
- power to act and make decisions;
- motivation; and
- sustainability.

Engaging stakeholders through co-management

Management approaches can be "top-down", i.e. fully implemented by, and the responsibility of, governments (usually central government); or "bottom-up", where community-based management entails full devolution of responsibilities to communities/fishers. In the real world, power sharing is usually somewhere in between these two extremes i.e. co-management.



Thus, co-management can be defined as partnership arrangement between key stakeholders and government to share the responsibility and authority for the management of the fisheries and coastal resources, with various degrees of power sharing.

It is import to recognize that co-management is not just a concept that involves the rural poor, local communities and government, but must incorporate all types of fishing and impacts on the resources. The co-management approach can be applied at any scale, from that of a single fleet sector, gear type, geographical area of a fishery, through to multi-stakeholder, multi-resource, multi-use situations, which will arise within the context of integrated management.

Although the principles of co-management are essentially the same in large-scale industrial fisheries as in small-scale artisanal fisheries, the policies and modalities for implementing them may differ. For example, having co-management and good stewardship of coastal resources by local communities without engaging the larger vessels from other localities is counter-productive and will inevitably lead to the breakdown of the system.

A key element in any co-management arrangement is building rapport, i.e. the feeling between two people that they can relate to each other. In many of the situations, establishing a rapport of trust is crucial for ensuring a message is received and understood as intended and resolve conflicts.

Examples of use

Co-management and active participation is common across many countries in the World. In Australia, USA, Canada and Europe where large-scale commercial fisheries often dominate, stakeholders are actively involved through co-management. In Australia, for example, the Commonwealth fisheries are managed through a co-management arrangement where a statuary authority (Australian Fisheries Management Authority or AFMA) is governed by a Commission consisting of government, industry and science stakeholders. Government only has a supervisory role. AFMA stakeholders are involved in developing fishery management and MCS plans.

Bottom-up involvement in fisheries management through co-management is increasing in many countries where small-scale artisanal fisheries are prevalent. Decentralization of the authority to management fisheries at the local level has facilitated this process, although in many cases, although the authority exists at the local level, the capacity to manage is not yet available. Local community co-management is often a fairly informal process guided by NGOs and donor projects, with little government support and a lack of sustainability after the project ends. In other countries such as the Philippines and Cambodia, more formal processes exist and better support from government is ensuring more sustained progress.

Annex 4: Marine spatial planning (MSP)

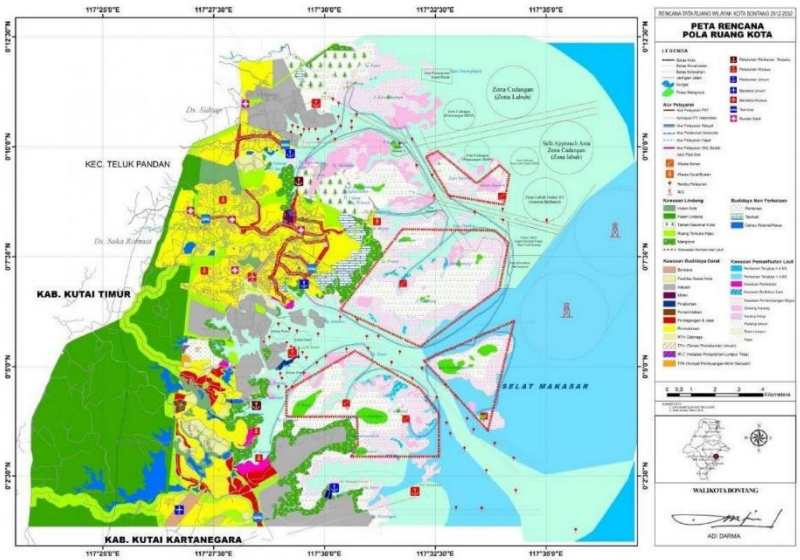
Background

MSP is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives. The purpose of MSP is to minimize the conflict among resource users and then bring about more effective marine management

The MSP process

MSP usually involves zoning different areas for different (and overlapping) uses. As with MPAs, this needs to be done in consultation with key stakeholders whose income, employment and livelihoods are affect by the zoning decisions. Once zones are defined and uses allocated, it is important that sufficient resources are available to ensure effective compliance and enforcement.

However, it is worth noting that MSP is not a replacement for sectoral planning and management, but rather an enabling framework for more strategic management. Zoning does not imply “sole use” by a specific activity, and MSP can assist in the formal management of marine space for multiple users with appropriate representation and conflict resolution.



If planned effectively and complied with by key stakeholders, MSP can reduce fishing pressure, protect and conserve critical habitats and reduce conflict among different users of the resources.

The MSP process can provide the certainty needed for investment and for development to take place, especially in activities such as aquaculture

As with most allocation processes, there are going to be “winners” and “losers”. The “losers” are often the poor and marginalized fishers and fishing communities. Decisions following MSP about where different activities take place, can disrupt centuries old fishing practices and arrangements, such as TURFs. Many fishing communities fish close to their villages, and if fishing is re-allocated to a new area, significant displacements can occur to the detriment to the fishers and their families.

Because the spatial scales are often large, compliance and enforcement can be difficult and expensive to carry out. Obviously, the success of the MSP relies on how well it is implemented.

Examples of use

Australia was the first nation to use MSP with the introduction of a zoning plan for the Great Barrier Reef Marine Park (GBRMP) in the early 1980s.

GBRMP Zoning
(see relevant *Zoning Plans* and *Regulations* for details)

	General Use Zone	Habitat Protection Zone	Conservation Park Zone	Buffer Zone	Scientific Research Zone *	Marine National Park Zone	Preservation Zone
Aquaculture	Permit	Permit	Permit*	×	×	×	×
Bait netting	✓	✓	✓ *	×	×	×	×
Boating, diving, photography	✓	✓	✓	✓	✓ *	✓	×
Crabbing (trapping)	✓	✓	✓ *	×	×	×	×
Harvest fishing for aquarium fish, coral and beachworm	Permit	Permit	Permit*	×	×	×	×
Harvest fishing for sea cucumber, trochus, tropical rock lobster	Permit	Permit	×	×	×	×	×
Limited collecting	✓ *	✓ *	✓ *	×	×	×	×
Limited spearfishing (snorkel only)	✓	✓	✓ *	×	×	×	×
Line fishing	✓ *	✓ *	✓ *	×	×	×	×
Netting (other than bait netting)	✓	✓	×	×	×	×	×
Research (other than limited impact research)	Permit	Permit	Permit	Permit	Permit	Permit	Permit
Shipping (other than in a designated shipping area)	✓	Permit	Permit	Permit	Permit	Permit	×
Tourism programme	Permit	Permit	Permit	Permit	Permit	Permit	×
Traditional use of marine resources	✓ *	✓ *	✓ *	✓ *	✓ *	✓ *	×
Trawling	✓	×	×	×	×	×	×
Trolling	✓ *	✓ *	✓ *	✓ *	×	×	×

PLEASE NOTE: This guide provides an introduction to Zoning in the Great Barrier Reef Marine Park. Relevant Great Barrier Reef Marine Park Zoning Plans should be consulted for confirmation of use or entry requirements.

* Additional restrictions / conditions apply.

ACCESS TO ALL ZONES IS PERMITTED IN AN EMERGENCY.

The People's Republic of China also gave a lead with its system of marine functional zoning, practiced in some Chinese waters since the late 1980s. This also classifies sea areas into zones, but of a much wider range than that for the Great Barrier Reef, including ports and shipping, fisheries, mining, tourism, energy, construction and MPAs.

The greatest concentration of MSP is currently in Europe. For example, Germany completed spatial plans for its EEZ in the form of legal ordinances in 2009. The Netherlands also took an early lead in Europe, beginning with the inclusion of the Dutch section of the North Sea in

national spatial planning policy, now culminating in a National Water Plan 2015, coordinated by an interdepartmental committee.

In other parts of the world, MSP tends to be at an earlier stage of development, and is often focused on environmental concerns. For example, in the Middle East, Abu Dhabi is finalizing a plan for its coastal and marine area to provide strategic guidance for future sustainable development that protects valuable habitats. As of 2019 MSP in one form or another is in progress for 18 Asia-Pacific countries, including Indonesia, Malaysia and the Philippines.

Annex 5: Sustainable Livelihoods Approach (SLA)

Background

Livelihood is defined as the capabilities, assets and activities required for a means of living. As fishery-based livelihoods are one of the most risk-prone activities, and are vulnerable to both environmental change and overexploitation of resources (Allison and Ellis 2001 in Bush and Minh 2005), the Sustainable Livelihoods Approach (SLA) is used to support livelihood improvement and sustainability and to engage in effective and holistic poverty reduction among fishers (FAO, n.d.). The SLA is based on 5 assets: human capital, social capital, natural capital, physical capital and financial capital (IMM 2008).

The main purpose of SLA is to secure and sustain livelihood. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the fisheries resource base (adapted from DFID, 2000).

The SLA framework

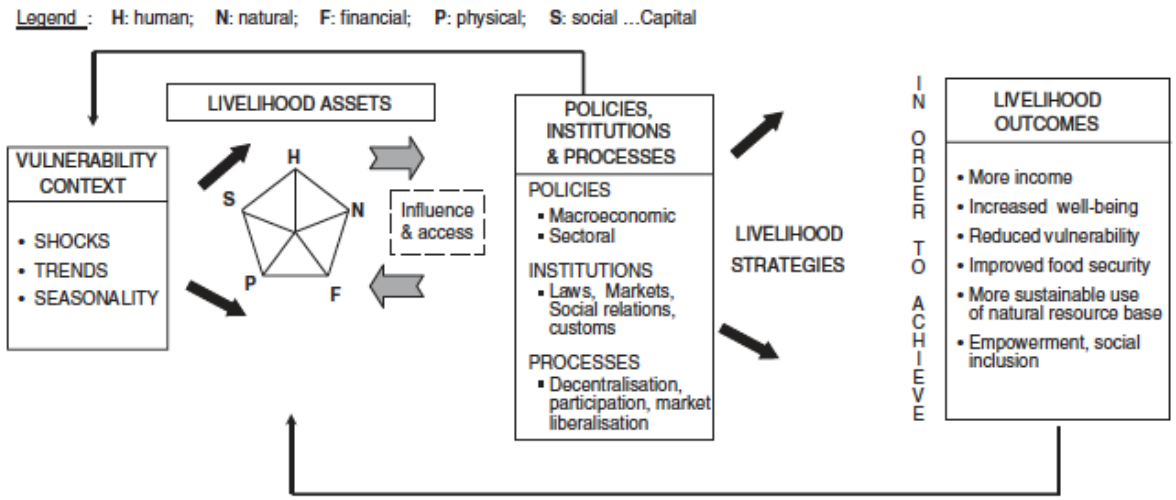


Figure 1: SLA Framework (Source: DFID 2000)

The components of the framework include:

1. Strengthen the 5 SLA capitals (Kollmair and Gamper 2002)
    a. Project, maintain or recover the *natural capital* and resources used by fishing communities.

b. Develop *social and human capital* in fisheries-dependent communities, being fisher-focused, putting their social and economic activities at the center, and building on their strengths and existing capabilities. Involve them in all the planning processes and in identifying their strengths, potentials, goals, needs, and enabling conditions.
c. Provide *financial capital* needed to start, strengthen and maintain sustainable livelihood options.
d. Ensure that *physical capital* is in place to support the livelihoods. This may include infrastructure, markets, transportation, and communications.

2. Transcend sectoral boundaries by building capabilities for diversifying agricultural, non-agricultural and natural resource collection activities in order to spread risk and reduce vulnerability to environmental and social disturbances (Ellis 2000 in Bush and Minh 2005). This means working in partnerships with other stakeholders in the public and private sectors, making links between local and national levels, and taking a broader view of sustainability to include economic, institutional, social and environmental dimensions in fishery management (Allison and Horemans 2006).
3. Support the development of appropriate policy and institutional environments.

The constraints to the approach include:

- A holistic approach such as SLA analysis needs time and both financial and human resources. Development projects often lack these conditions.
- Being holistic inevitably comes with multidimensional realities that can be difficult to cope with.
- Improving the livelihoods of fishers may result in costs to other groups.
- Balancing social and environmental sustainability is often a challenge.

Examples of use

The SLA has been widely used in coastal and fisheries development research and has informed the design of development programs by the United Nations Development Programme (UNDP), CARE, and the Department for International Development (DFID). In the Sustainable Fisheries Livelihoods Programme, which involves 25 West African countries, the SLA has helped to align fisheries policy with wider poverty reduction initiatives and to identify means of contributing to poverty reduction that do not directly increase pressures on fully or over-exploited fish resources (Allison and Horemans 2006).

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Annex 6: Community-based ecosystem approach to fisheries management (CEAFM)

Background

CEAFM is a management of fisheries, within an ecosystem context, by local communities in collaboration with a governmental fisheries agency and other partners. CEAFM combines fisheries management, ecosystem management, and community-based management. The close involvement of communities emphasizes that humans are an integral part of ecosystems and their needs must be addressed (SPC 2010).

The main purpose of CEAFM is to provide an alternative to stock and species-based, harvest-orientated, top-down legal mandates of the 1970s and 1980s, fostering an ecosystem and community-based orientation toward fisheries management focused on the enhancing the capacity and engagement of local resource users through participatory planning and implementation, as well as through decentralizing management authority and responsibility to the local level.

Implementing CEAFM

Following the comprehensive approach of EAFM, community involvement is maximized in this approach and integrated with input and expertise from agencies and other partners.

The principles for the development of CEAFM are as follows (SPC 2010)

- Keep the process simple
- Respect local customs and protocols
- Provide motivation
- Maximize community participation
- Make use of traditional knowledge
- Use science to support community objectives
- Enlist the support of a broad range of government agencies
- Use a demand-based system
- Adopt a precautionary approach
- Manage human activities
- Suggest alternatives to the overexploitation of resources
- Develop supporting legislation for CEAFM

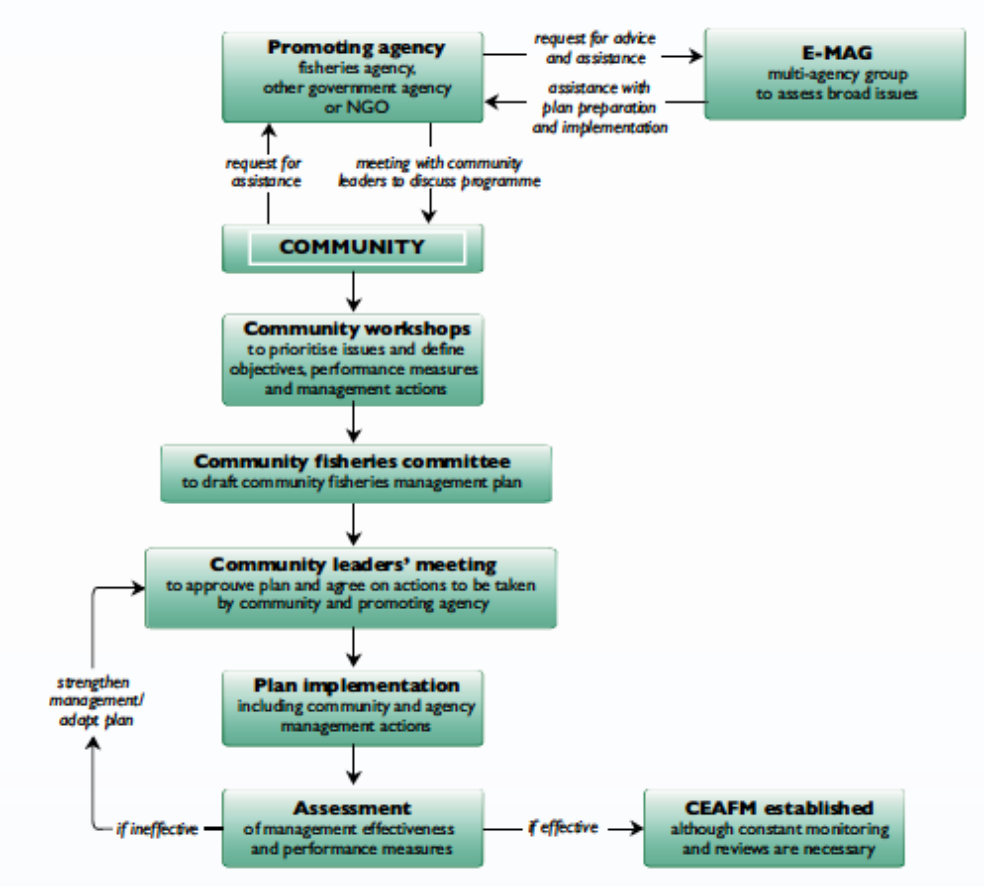

Figure 1: Process of implementing an CEAFM (Source: SPC 2010)

Implementing a CEAFM includes the following steps (SPC 2010)

1. Set-up tasks for the promoting agency
   - 1.1 Define broad goals and strategies, based on principles of maximum community participation, motivation rather than education, and being demand-based
   - 1.2 Raise public awareness of the need to protect ecosystems
   - 1.3 Review the work of other groups working in communities
   - 1.4 Establish a consultative multidisciplinary group
   - 1.5 Establish a formal or legal basis for CEAFM
   - 1.6 Provide community facilitators with appropriate skills
   - 1.7 Develop a culturally appropriate process
2. The community involvement process
   - 2.1 Assess community requests
   - 2.2 Define the project's scope of the managed area
   - 2.3 Identify and prioritize key issues
   - 2.4 Develop community goals and objectives
   - 2.5 Determine management actions and responsibilities
   - 2.6 Define indicators and performance measures
   - 2.7 Produce a community-owned management plan

3. Formalizing and implementing a community management plan
4. Monitoring performance; reviewing and adapting the plan

Advantages

- Allow fishers and fishing communities, who are the most dependent on the fisheries resources, to play a larger role in resource management decision-making and implementation.
- Increases communities' motivation and involvement in managing their fisheries.
- Better addresses and responds to the issues that are most important for the fishers and fishing communities.
- Increases prospects for effective and sustainable management as the management goal is often not for profit.
- Increases opportunities for equitably distributing the benefits derived from fisheries resources to the communities.

Disadvantages

- Lack of adequate access to a variety of resources that is essential for successful planning and implementation.
- Needs to have or build enabling conditions. These in include institutions and organizational structures that can provide sufficient resources and support for effective management, offer community participation incentives, disseminate information, enhance communication and coordination capacity, and foster environmental sensitivity and other relevant capacities.
- While the concept is good, it is difficult to translate into reality as it takes time and experience. The principles may not equally ensure public participation, resource distribution, or effective responses for local environmental conservation planning. Good communication and adequate time are needed to build trust and full participation.

Examples of use

After the enactment of the Local Government Code of 1991, the Philippines government actively promoted community-based fisheries management (CBFM) to conserve coastal resources. Compared to other countries, the Philippines has the highest number of the CBFM projects and programs. Over 1,000 projects have been implemented by the government, NGOs, fishing communities and academic and research institutions. The outcomes indicate a positive impact of CBFM on equity in relation both to involvement in management and to benefit sharing and sustainable management of fisheries resources (Yang and Pomeroy 2017).

The Gulf of Alaska Coastal Communities Coalition supports marine-dependent communities that were facing the loss of jobs, income and infrastructure because of market value shifts, transportation issues, raising fuel costs, and regulatory issues. Through the efforts of the coalition, the North Pacific Council adopted and NOAA has approved a new program that

will allow community quota entities (CQEs) to purchase quota shares in the halibut and sablefish fishery in the Gulf of Alaska Coast. Shares are held by non-profit organizations which incorporated under state or tribal regulations, and which then lease annual individual fishing quotas to local residents. The program defines the communities that qualify, sets out the rules for purchase and leasing, and requires participants to abide by the same rules as other quota-holders in the fishery. Now that this structure is in place, communities are getting back into a fishery in which they traditionally participated (Weber and Ludicello. 2005).

In the floodplains of Bangladesh, a CGIAR project implemented by WorldFIsh used community-based fisheries culture as an example of how a community- and ecosystem-based approach can provide win-win outcomes for communities, commercial production, and the environment. The project worked with existing cooperatives to stock large fingerlings, using local farmers to identify aquatic weeds and plants that improved the productivity of fish species, and built leadership skills and instilled shared goals of equitable access and benefit sharing among cooperative members (CGIAR).

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