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Ecosystem approach to fisheries and aquaculture: Implementing the FAO Code of Conduct for Responsible Fisheries







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Ecosystem approach to fisheries and aquaculture: Implementing the FAO Code of Conduct for Responsible Fisheries

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FOREWORD

This publication provides guidance on how to implement the FAO Code of Conduct for Responsible Fisheries (CCRF) using an ecosystem approach to fisheries and aquaculture. The CCRF is a voluntary code covering all aspects of the management and development of fisheries and is designed to ensure that they are developed sustainable without adversely affecting the livelihoods of local communities that share the same resources as the fisheries.

The authors outline the basic principles of the CCRF, describe concrete steps to be taken to use the ecosystem approach effectively, and recommend certain institutional changes and reforms that will be necessary in the Asia-Pacific region if the potential of the ecosystem approach is to be realized.

The most significant reform that is needed to achieve the potential of the ecosystem approach to fisheries and aquaculture is a paradigm shift in policy from one that is production oriented to one that is benefits oriented (social and economic). There is evidence that this is already happening in the region with efforts being made to limit access, reduce the number of fishing vessels and introduce community-based rights systems. Stakeholder participation is essential and existing legal instruments and practices that interact with or impact fisheries may also need to be reconsidered, and adjustments made where necessary. In the future, it may even be necessary to regulate the inter-sectoral interactions and impacts through primary legislation, e.g. laws controlling coastal development.

To promote broader adoption and implementation of the ecosystem approach by member countries, a wide range of regional activities is suggested by the authors and includes a media campaign, the building of fishery alliances among countries and capacity building in fishery agencies.

Ensuring the sustainable development of fisheries is crucial if food security and economic well-being are to be achieved throughout the APFIC region. Hopefully the ideas included in this publication will help shape the future of fisheries in the region.

He Changchui
Assistant Director-General and
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INTRODUCTION

This review is intended to provide a simple guide on how to implement the FAO Code of Conduct for Responsible Fisheries (CCRF) through an Ecosystem Approach to Fisheries and Aquaculture (EAF/EAA). EAF and EAA are not new planning and management frameworks, but are strategies to achieve sustainable development in fisheries through the implementation of the FAO Code of Conduct for Responsible Fisheries (CCRF). The CCRF is a global set of recommendations about how responsible fisheries and aquaculture can be conducted in a manner that contribute to sustainable development. Sustainable development can best be defined as:

> *Development which meets the needs of the present without compromising the ability of future generations to meet their own needs.*

Development as used in this definition refers to improvement in the overall quality of life, as "human well-being" that needs to be balanced with "ecological well-being" to ensure that future generations have the same options and choices for development as does the present generation. In its simplest form this can be thought of as a process for finding a balance so that development does not destroy the natural resource base on which it is dependent and overprotection of the resources does not prevent rational development. Sustainable development also relies on effective governance as a key mechanism for achieving both human well-being and ecological well-being.

If we accept that the use of EAF/EAA is a practical means of implementing the CCRF and thereby making a contribution to sustainable development, then we need to:

- understand the basic principles of the CCRF;
- explain how EAF/EAA can assist in implementing the code;
- describe how to make EAF/EAA operational;
- acknowledge the differences and similarities of fisheries and aquaculture in Asia and the Pacific region compared with other regions of the world and decide on institutional changes and reforms that will be needed to bring about EAF/EAA; and
- examine regional arrangements that would facilitate EAF/EAA.

Each of these topics is addressed in this document. This document also attempts to demystify much of the jargon currently being used and the seemingly wide range of approaches being advocated by different interest groups. This is covered in section 2 under the heading "Parallel evolution of the different approaches" and includes information on:

- Ecosystem approach to fisheries (EAF)
- Ecosystem approach to aquaculture (EAA)
- Ecosystem-based fisheries management (EBFM)
- Ecosystem-based aquaculture management (EBAM)
- Sustainable livelihoods approach (SLA)
- Wealth-based fisheries management (WBFM)
- Integrated coastal management (ICM)
- Integrated coastal resource management (ICRM)
- Integrated coastal area management (ICAM)
- Integrated catchment management (ICM)
- Coastal zone management (CZM), and
- Integrated coastal zone management (ICZM).

The Asia-Pacific Fishery Commission (APFIC) expects that there will be increasing interest in the application of the ecosystem approach to fisheries and aquaculture and that this will result in documented case studies of the experiences of different countries.

A longer-term goal is the development of some clear guidelines on how to establish EAF/EAA based management that can be applied by APFIC members. To achieve this, it is recommended that fishery and aquaculture agencies in the APFIC member countries devote more time and effort into planning for fisheries and aquaculture management, particularly by:

- agreeing on what it is that a country or fishery is trying to achieve through management (objectives);
- how it is proposed to do this (strategies); and
- how success or needs for revision of plans will be reviewed and measured (monitoring).

BASIC PRINCIPLES OF THE FAO CODE OF CONDUCT FOR RESPONSIBLE FISHERIES (CCRF)

Main principles and ecosystem linkages

The FAO Code of Conduct for Responsible Fisheries (CCRF) was unanimously adopted in 1995 by the FAO Conference. The CCRF is voluntary, although parts are based on international law, including the 1982 United Nations Convention on the Law of the Sea (UNCLOS). The CCRF covers all aspects of management and development of fisheries, including capturing, processing and trade of fish products, fishing operations, aquaculture, fisheries research and the integration of fisheries into integrated coastal area management (ICAM). The code is organized into 12 articles covering these areas:

- Article 1 Nature and Scope of the Code
- Article 2 Objectives of the Code
- Article 3 Relationships with other International Instruments
- Article 4 Implementations, Monitoring and Updating
- Article 5 Special Requirements of Developing Countries
- Article 6 General principles
- Article 7 Fisheries Management
- Article 8 Fishing Operations
- Article 9 Aquaculture Development
- Article 10 Integration of Fisheries into Coastal Area Management
- Article 11 Post-harvest Practices and Trade
- Article 12 Fisheries Research.

In the context of fisheries management in Asia, and in particular, small-scale fisheries, the articles of most relevance are the Articles on General Principles (Article 6), Fisheries Management (Article 7), Aquaculture Development (Article 9) and Integration of Fisheries into Coastal Area Management (Article 10).

The CCRF sets out some important principles for responsible fisheries (see Box 1 for those relating to fisheries resources and Box 2 for aquaculture). These principles require that fisheries/aquaculture managers embrace some important concepts. First, they require endorsement of the concept of sustainable development by promoting the maintenance of fishery resources in sufficient quantities for both present and future generations. Second, they require managers to consider the three dimensions of sustainable development – ecological, social and economic, not just the biological/ ecological dimension.

Box 1: Main principles of the FAO Code of Conduct for Responsible Fisheries relating to fishery resources and their management*

- Fisheries management should maintain fishery resources *for present and future generations*.
- States should prevent overfishing and excess fishing capacity to ensure that fishing effort is *commensurate with the productive capacity* of the resources.
- Conservation and management measures should be *based on the best scientific evidence* (environmental, social and economic) available, also *taking into account traditional knowledge.*
- The *precautionary approach* should be applied – the absence of adequate scientific information *should not be used as a reason for postponing actions*.
- The *rights of fishers and fishworkers should be protected*, particularly those engaged *in artisanal small-scale fisheries.* The right to a just livelihood as well as preferential access, where appropriate, to traditional fishing grounds must be respected.

* *These principles are paraphrases of original clauses in the CCRF (see FAO, 1995)*

Box 2: Main principles of the FAO Code of Conduct for Responsible Fisheries relating to aquaculture development

- States should produce and regularly update aquaculture development strategies and plans to ensure that aquaculture development is *ecologically sustainable* and to allow *rational use of resources shared by aquaculture* and other users.
- States should ensure that the livelihoods of local communities, and their access to fishing grounds, *are not negatively affected* by aquaculture developments.

The principles also cover some important ecosystem concepts (Box 3) to ensure the conservation of all species belonging to the same ecosystem as well as protection of important ecosystem components such as wetlands, mangroves, reefs, lagoons, nursery and spawning areas.

Many accounts of EAF/EAA reiterate these principles, but this is not really necessary as they were well-formulated and articulated in the CCRF.

EAF/EAA should focus more on what needs to be done to make the high-level principles of the CCRF operational and functional.

The CCRF also recognizes the special requirements of developing countries, especially in the areas of financial and technical assistance, technology transfer, training and scientific cooperation and in enhancing their ability to develop their own fisheries as well as to participate in high seas fisheries, including access to such fisheries.

Box 3: Main principles of the CCRF relating to the ecosystem

- Management measures should not only *ensure the conservation of target species* but *also species* belonging to the *same ecosystem.*
- States should *facilitate consultation* and *effective participation* of all stakeholders.
- *All critical habitats*, such as wetlands, mangroves, reefs, lagoons, nursery and spawning areas, should be *protected and rehabilitated.*
- States should ensure that their fishery interests are taken into account in the *multiple uses of the coastal zones* and are *integrated* into coastal area management.
- States should *promote responsible development and management of aquaculture,* including evaluation of the effects on genetic diversity and ecosystem integrity.
- States should *establish effective procedures* to undertake appropriate environmental assessment and monitoring with the aim of minimizing adverse ecological changes and related economic and social consequences.

FAO International Plans of Action

To strengthen the implementation of the code, a number of international plans of action (IPOA) have been developed and adopted. All of these IPOA call for states to develop national plans of action (NPOA) to deal with several important global fishery issues at the national and local levels. These are:

- IPOA for reducing incidental catch of seabirds in longline fisheries;
- IPOA for the conservation and management of sharks;
- IPOA for the management of fishing capacity; and
- IPOA to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing.

FAO Technical Guidelines for Responsible Fisheries

When the FAO Conference adopted the code, it also requested the secretariat to develop technical guidelines to support its implementation. Many of the articles in the Code are now covered. To date, 15 guidelines have been prepared by international experts and published. These are:

- Fishing Operations
- Suppl. 1 Vessel Monitoring Systems
- Precautionary Approach to Capture Fisheries and Species Introductions
- Integration of Fisheries into Coastal Area Management
- Fisheries Management
- Suppl. 1 Conservation and Management of Sharks
- Suppl. 2 The Ecosystem Approach to Fisheries
- Aquaculture Development
- Suppl. 1 Good Aquaculture Feed Manufacturing Practices
- Suppl. 2 Health Management for Responsible Movement of Live Aquatic Animals
- Inland Fisheries
- Responsible Fish Utilization
- Indicators for Sustainable Development of Marine Capture Fisheries

- Implementation of the International Plans of Action to Deter, Prevent and Eliminate, Illegal, Unreported and Unregulated Fishing
- Increasing the Contribution of Small-scale Fisheries to Poverty Alleviation and Food Security.

Although not part of this technical series, guidelines for the ecolabelling of fish and fishery products from marine capture fisheries have also been published.

Benefits and costs of implementing the code

Not implementing the CCRF effectively has been extremely costly, both in terms of ecological and socio-economic damage in many countries in Asia and the Pacific region. Many countries are now experiencing:

- intra- and inter-sectoral conflicts;
- depleted fishery resources;
- degraded coastal environment and critical fisheries habitats;
- dissipated resource rents;
- illegal fishing;
- inequitable distribution of benefits from harvest and post-harvest activities; and
- increased poverty in small-scale artisanal fisheries and aquaculture.

All these could be avoided by better fisheries and aquaculture management. Fish resources are inherently valuable, in many cases extremely valuable. The exploitation of such resources is capable of generating substantial amounts of wealth on a sustainable basis and it has been estimated that the annual return now wasted at a global level is in excess of US$50 billion.

A corollary to this loss is the need to prop up fisheries by providing subsidies. A study by Sumaila and Pauly (2006) estimates that world fisheries are currently subsidized at between US$30 billion and US$34 billion per year. A question which society should be asking is:

> *Why do governments continue to pay over US$30 billion a year to support fisheries, when in fact they could earn at least US$50 billion more in resource rent that could be re-invested to support all sorts of activities, especially the reduction of poverty?*

Another major advantage of implementing effective fishery management is to be able to benefit from the increasing trend of ecolabelling. More and more major supermarkets are now giving their consumers a choice between products that are certified as being harvested in an ecologically sustainable way compared to products that are not, especially among consumers of developed countries that are the major markets for fish from developing countries. The consumer's preferences are expected to result in increased prices and/or market share for products that can be certified as ecologically sustainable. Fisheries and aquaculture managed under EAF/EAA stand to gain from any price/market differential in the future.

IMPLEMENTING THE CCRF THROUGH EAF/EAA AND CO-MANAGEMENT

What is the ecosystem approach?

To understand concepts such as the ecosystem approach, one must first understand the concept of sustainable development that replaced previous policies of development based on economic growth only. Sustainable development can be summarized as a balance between ecological well-being and human well-being that does not compromise the needs of future generations. In its simplest form this can thought of as a process for finding a balance between ecological well-being and human well-being so that development does not destroy the natural resource base on which it is dependent but avoids overprotection of resources that prevents rational development (Figure 1).

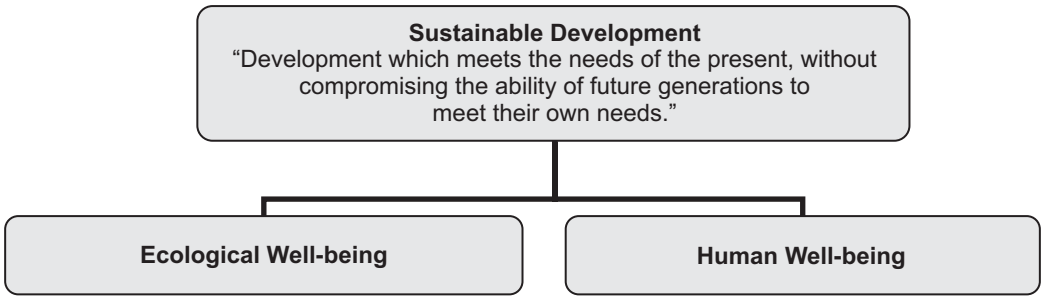


Figure 1 Sustainable development – a balance between ecological well-being and human well-being

The phrase "ecosystem approach" was first coined in the early 1980s, but found formal acceptance at the Earth Summit in Rio in 1992 where it became an underpinning concept of the Convention on Biological Diversity (CBD) that was later described as:

> *A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.*

In other words, the ecological approach is a strategy to promote sustainable development. The application of the ecosystem approach helps reach a balance of the three objectives of the CBD: conservation; sustainable use; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

What is the ecosystem approach to fisheries and aquaculture?

FAO's definition of the ecosystem approach to fisheries and aquaculture (EAF and EAA) is longer but reflects the same concept as the more general definition of the ecosystem approach:

> *An Ecosystem Approach to Fisheries (or Aquaculture) strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries. (FAO, 2003).*

Or put more simply:

> *EAF/EAA is a way of managing fisheries and aquaculture that balances the different objectives of society (e.g. ecological and economic objectives), by applying an integrated approach across geographical areas that reflect natural ecosystems.*

In this definition, the word ecosystem is used to address the fishery system as an integrated social-ecological system, *with humans being an integral part of the ecosystem*. The definition also addresses both human and ecological well-being thus combining two concepts: that of conserving biodiversity, ecosystem structure and functioning, and that of fisheries management dealing with providing food, income and livelihoods for humans. These areas can be further subdivided into policy objectives and issues which need to be addressed (see Figure 2).

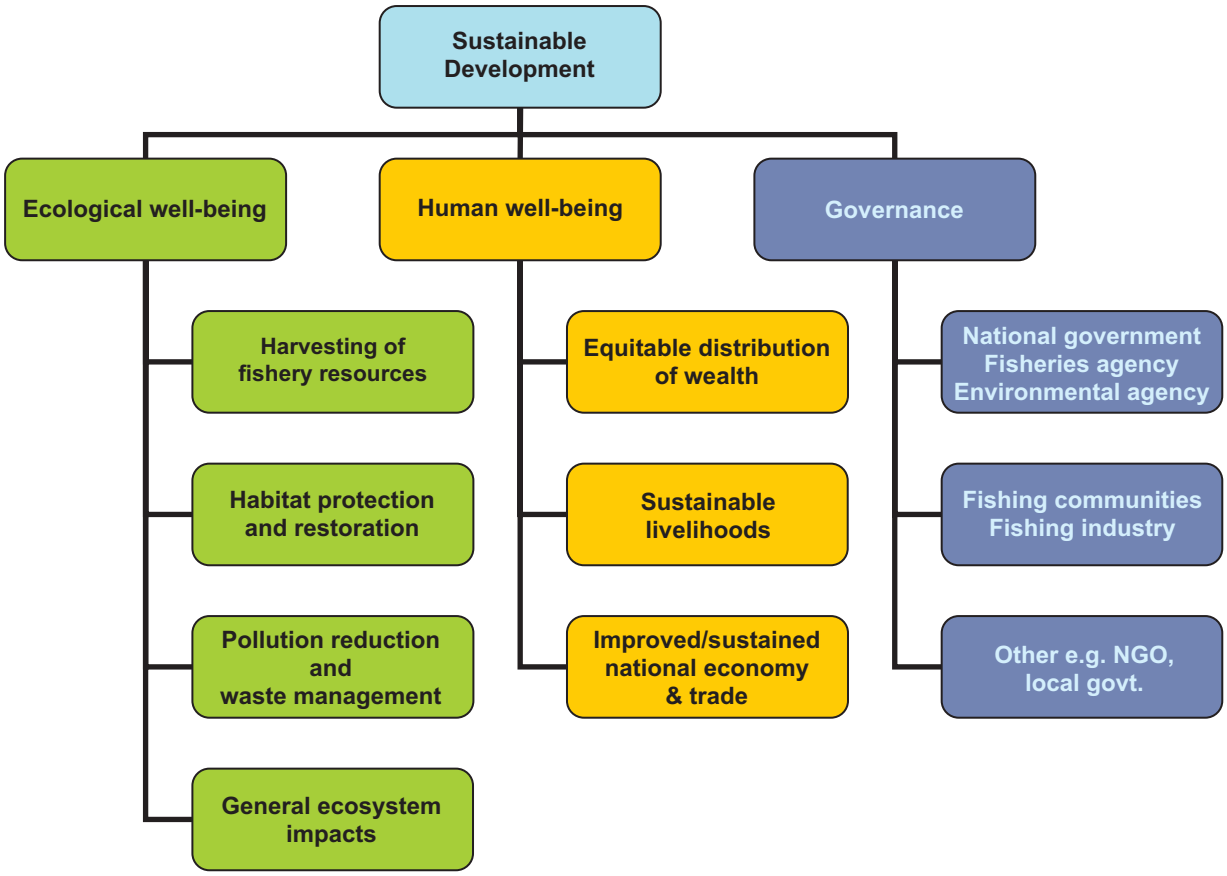


Figure 2 Expanded tree of sustainable development, with subsidiary policy objectives or issues which are relevant to planning under the ecosystem approach to fisheries framework

Parallel evolution of approaches and jargon

With the adoption of sustainable development as a core concept, many sectors/disciplines started to look at approaches they could use to achieve sustainable development. Because all these approaches are based on the same concept, they all end up with the same principles with the two main differences among them being the balance between ecological well-being and human well-being, and the number and scope of sectors being considered. The following account gives a few examples of different variations of the ecosystem approach developed by different players.

Ecosystem approach to fisheries, and ecosystem-based fisheries management

EAF developed as fisheries managers and the society at large realized that the single-species approach tended to ignore the interactions between the species themselves, as well as the interactions with the broader ecosystem. It soon became apparent that single-species management often did not result in optimizing the economic and social benefits of the fishery as a whole, especially in tropical multispecies/multigear fisheries where implementation was difficult.

At the same time that these fisheries managements systems were evolving, aquatic environmental agencies were attempting to conserve the ecosystem and their inherent biodiversity, through ecosystem management approaches and interventions such as marine protected areas (MPAs).

Over time, the concepts of single-species fishery management and the concept of ecosystem management evolved and merged into a single concept. This was called EAF by the fishery managers and "ecosystem-based fisheries management" (EBFM) by environmental managers. Confusingly, these terms are often used interchangeably, but in some cases they are quite different. To assess what is meant by these terms, one has to read the "fine print" where the concepts are defined and elaborated. However, the main difference, if it occurs, is that EBFM will consider only the ecological impacts of fishing, whereas EAF is a broader concept and also considers the impact of the environment on fishing, the impact of fishing on the environment and the socio-economic benefits that can be gained from fishing and post-harvest activities.

Ecosystem approach to aquaculture, and ecosystem-based aquaculture management

As for fisheries, the ecosystem approach to aquaculture and ecosystem-based aquaculture management (EBAM) are variants of the same approach and are single sector examples of the ecosystem approach. Both EAA and EBAM consider the impacts of the environment on health and productivity of cultured organisms and the impacts that aquaculture has on all aspects of the marine ecosystem. As with its parallel in fisheries, EAA is a broader concept and also focuses more on the socio-economic benefits that can be gained from aquaculture and post-harvest activities.

Integrated coastal management

At the same time that fisheries managers were adopting a much broader ecosystem approach and environmental managers were adopting a much more people-orientated approach, an overarching framework was also being developed to facilitate the integration of sectoral management and environmental management. In the coastal region, this came to be known as integrated coastal management (ICM) (also known as integrated coastal area management (ICAM), integrated coastal resource management (ICRM), coastal zone management (CZM), integrated coastal zone management (ICZM)), and in inland areas as integrated catchment management (ICM). ICM provides a convenient framework for fishery agencies and environmental agencies and others to work together to promote responsible fisheries based on a healthy environment, although there are not many cases where this has happened.

Sustainable livelihoods approach

Yet another approach was also being developed by people working more at the grassroots level, especially in poor villages and communities who adopted a holistic framework, known as the "sustainable livelihoods approach", based on five asset groups in communities – natural, social, human, physical and financial.

Wealth-based fisheries management

Another variant of the ecosystem approach to fisheries is known as wealth-based fisheries management (WBFM). This approach has been advocated by economists who contend that reforms should focus on creating and managing wealth in the first instance rather than on objectives such as environmental sustainability. They argue that management that focuses on the establishment and enforcement of environmental limits tends to ignore the incentives and rights of the resource users.

WBFM begins with the clear recognition that fish resources are inherently very valuable and that this value or wealth exists in the form of potential resource rents. The generation and appropriate use of

resource rents will enable the achievement of various existing goals (e.g. economic growth, poverty alleviation, resource conservation etc.).

Large marine ecosystems and other approaches

Other broader concepts such as large marine ecosystems, ecosystem-based management, and integrated ocean management deal with the management of several sectors (e.g. fisheries, shipping, tourism, and mining) and are just more generic cousins of the terms discussed above. All include a recognition that management must deal with the full set of ecological consequences of an activity and try to optimize the social and economic benefits of that activity.

So which approach?

All the approaches are based on the same principles and therefore in essence all can be used to guide fisheries and aquaculture management. Sustainable development should be the goal and the approaches just provide strategies that are being used by various sectors/agencies to work towards this goal.

However, from a fisheries and aquaculture perspective, the EAF and EAA provide a broad framework that can be used at different scales and also uses tools that can customize EAF/EAA by allowing a prioritization process of major issues and the setting of objectives. Within EAF/EAA, one can give priority to the economic, social and ecological objectives to suit the national policy setting, local conditions and aspirations of major stakeholders. In this way it can support ecosystem-based fishery/aquaculture management or wealth-based fishery management, depending on whether the primary focus is on the environment or wealth.

A key point to remember is that EAF/EAA and the other approaches do not provide the “answers”: they only assist in helping the government and stakeholders in trying to find these. The issues that need to be addressed and how to address them comes from the people involved in the management of the fishery.

The following section uses EAF as the main focus but many of the challenges and techniques for meeting these challenges are the same or similar for EAA.

THE MOVE TO THE ECOSYSTEM APPROACH TO FISHERIES

A framework for EAF

As described above, the main objective of EAF is the sustainable use of the whole system, not just a single species. EAF aims to increase the contribution of fisheries to sustainable development through considering ecological constraints (e.g. habitat protection and restoration, pollution reduction and waste management, sustainable harvesting of fishery resources) as well as socio-economic benefits to humans (e.g. increased and equitably distributed wealth and sustainable livelihoods) (Figure 3). Thus, assessments, decision-making and management all need to change (Table 1).

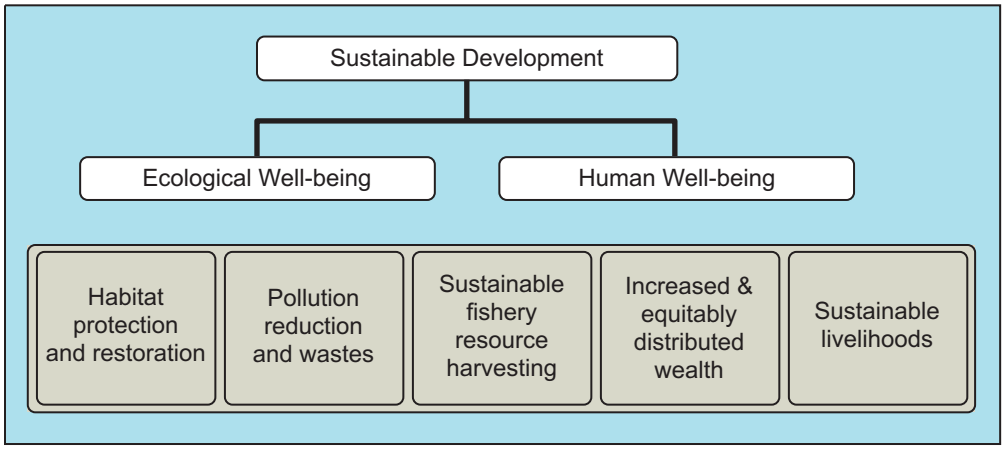


Figure 3 Ecosystem approach to fisheries framework

Table 1 Moving from conventional single-species management to EAF

	Conventional fisheries management	Ecosystem approach to fisheries
Species considered	Target species	All species in ecosystem, particularly those impacted by fishing
Assessment method	Stock assessments	Multispecies assessments/indicators
Management objectives	Mainly biological	Ecological, economic and social
Policy and decision-making	Largely government	Participatory with major stakeholders
Management intervention	Mainly control of fishing	Broad-based incentives (including ecosystem tools such as MPAs).

The challenges of EAF

The success of EAF depends on reaching a balance at two different levels. One level is finding the balance between conservation and sustainable use of fishery resources within the limits of ecosystem functioning (see Box 4). Another is the integration of ecological, economic and social objectives into the management of specific geographical areas. EAF requires commitment to overcome difficulties (both conceptual and practical) of making choices that require trade-offs and compromises among different sectors of society. This requires long-term political will (backed with sufficient resources) and also short-term economic and social support, particularly for the local stakeholders. However, as noted above the benefits could be very large, if successful.

Box 4: Conflicting objectives of different stakeholders

Some objectives may be contradictory because they represent contradictory policy goals and/or contradictory interpretations of them. Unnecessary contradictions should be avoided, but the contradictions may also represent real competing demands that the fishery management process seeks to balance. The process of *reconciling these competing demands lies at the heart of EAF* and can be informed by adaptive management.

The trade-offs involved in reconciling these differences may mean that that some or all of the stakeholders will have to alter their expectations about the results to be obtained from the ecosystems and/or the fisheries.

Equitable sharing of costs and benefits is a major challenge because conservation measures often impose livelihood costs on the local stakeholders and vice versa. In developing countries, this difficulty is compounded by the fact that at the public sector level there are multiple agencies from the fisheries, environment and others, often working at cross-purposes. There is a need for an integration of these to move towards more equitable sharing.

In many cases, the required management action lies outside the scope of the fisheries agency and there is a need for better cooperation among agencies and stakeholders, especially during the planning stages of EAF. Ironically ICM in both coastal and inland waters can provide a platform for this, but to date fisheries agencies have been reluctant to participate. Once this important step has been achieved, day-to-day management of fisheries can then be left to the fisheries agency to deliver, with regular meetings of other concerned stakeholders to assess progress and resolve any conflicts that may have arisen.

Implementing the EAF usually implies a higher management cost to cover the broader data and information needs, the planning and consultative decision-making process, as well as a wider scope for monitoring, control and surveillance (MCS). Although these costs should be outweighed by the longer-term benefits, the question of "who pays?" will often be important, especially in a transition phase of implementation. The idea that the beneficiary pays is becoming increasingly accepted. Because the CCRF also responds to wider societal needs, the costs theoretically should be divided between those people who are benefiting directly, such as fishers, and society at large.

Meeting the challenges – moving from principles to actions

The key to EAF is to "translate" the high level principles of the CCRF (and other related international instruments) into objectives and actions that can be implemented in a given fishery. These objectives need to be specific enough that one or other management intervention can address it and the success (or otherwise) of this intervention can be monitored and assessed. At this operational level, priorities can be set through a risk assessment process and tradeoffs and balances reached by consensus. The translation starts with converting the high level principles into policy goals and broad objectives for the fishery. These are then broken down into specific objectives (Figure 4).

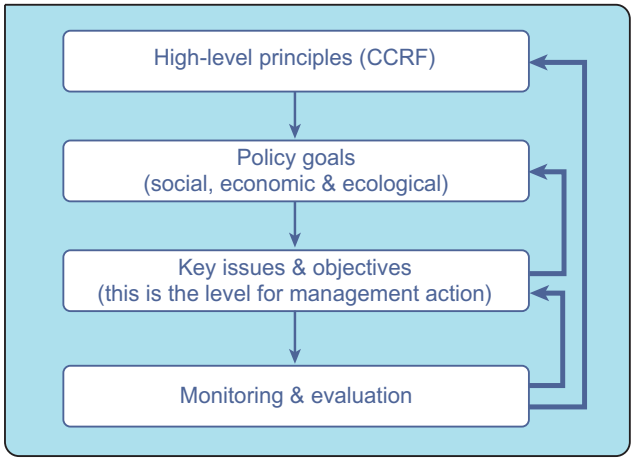


Figure 4 Making the code of conduct operational by translating principles to objectives. Based on FAO (2003)

From principles to policy goals

Many of the principles underpinning EAF are so generic that they cannot really be implemented. Furthermore, many of the characteristics of ecosystems, such as ecosystem health, integrity, resilience, energy flows, are relatively abstract concepts that are not fully understood and difficult to apply in practice. However, these can stay as nice principles and abstract concepts provided that they can be turned into higher-level policy goals that make sense, such as conserving biodiversity, maintaining fishery habitats, protecting important food chain functions and so on. These usually form the basis of national policies and plans.

From policy goals to implementation

These higher-level policy goals then need to be broken down into more specific issues, each with its own objective that can be achieved by applying a management measure. These need to be at a practical operational level and be inclusive for target stocks, habitat, bycatch, protected species, income and social aspirations of the fishers etc. (See next section for a framework for setting objectives and developing performance monitoring). Provided there is a good linkage between the CCRF principles and the objectives, implementing the objectives, operationalizes the CCRF.

Making EAF participatory through co-management

Co-management is the tool to make EAF more participatory. It describes the spectrum of shared management between the extremes of exclusively community-based management (with full devolution of responsibility to communities/fishers) through to central government management (with full responsibility controlled by government) (Figure 5).

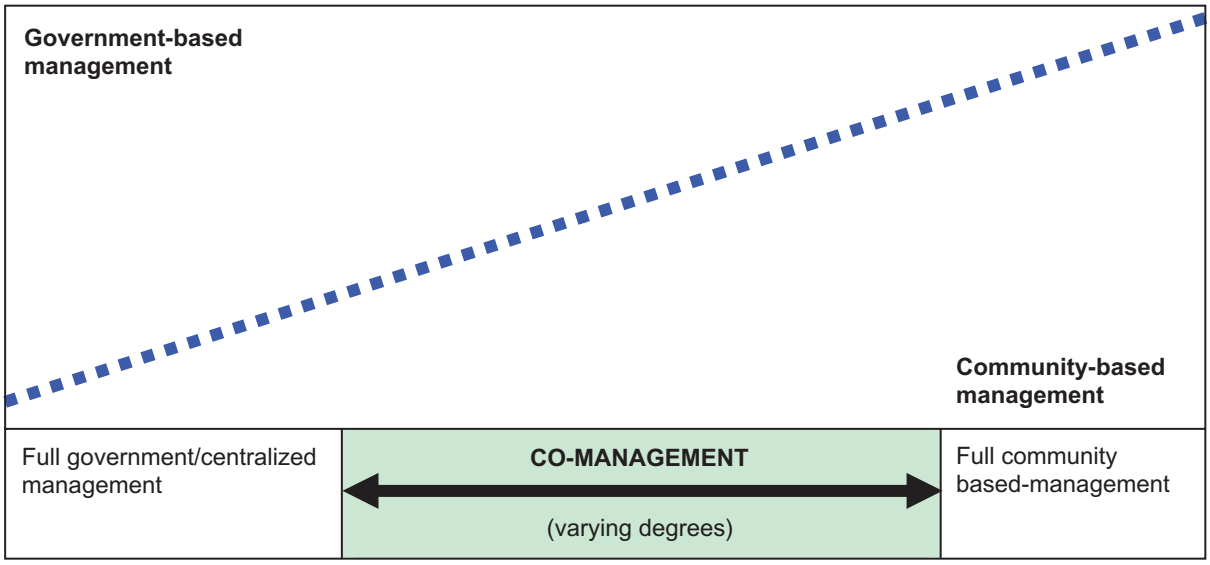


Figure 5 Co-management between government and stakeholders (based on Pomeroy and Berkes, 1997)

Fisheries co-management is:

> *A partnership approach where government and the fishery resource users share the responsibility and authority for the management of a fishery or fisheries in an area, based on collaboration between themselves and with other stakeholders, especially NGOs.*

Recent experience with piloting co-management in many countries in the region has shown that the process can be very successful and that those harvesting the resources are capable of managing the fishery for specific purposes (this may not always focus on the resource but may be more directed towards conflict reduction, removal of destructive gear, etc.). As per EAF procedure, these should reflect the issues identified by the stakeholders.

Co-management is not just a concept that involves the rural poor and local communities, but must incorporate all types of fishing and impacts on the resources. If focused only on small-scale artisanal fisheries there is a high risk that even if there is good stewardship of coastal resources by local communities, these same resources could be exploited by larger vessels from other localities (the "outsider" problem). This will inevitably lead to the breakdown of the local system.

Key actors and stakeholders

The network of stakeholders that need to be involved in EAF is complex (Figure 6), both in terms of vertical linkages (national to local), horizontal linkages (between different users of the natural resources) and in terms of geographic coverage. A communication and information exchange network is critical for success. But what information is needed by the different players and in what form? Much more work is needed to determine what the information needs are and how to manage this huge amount of information.

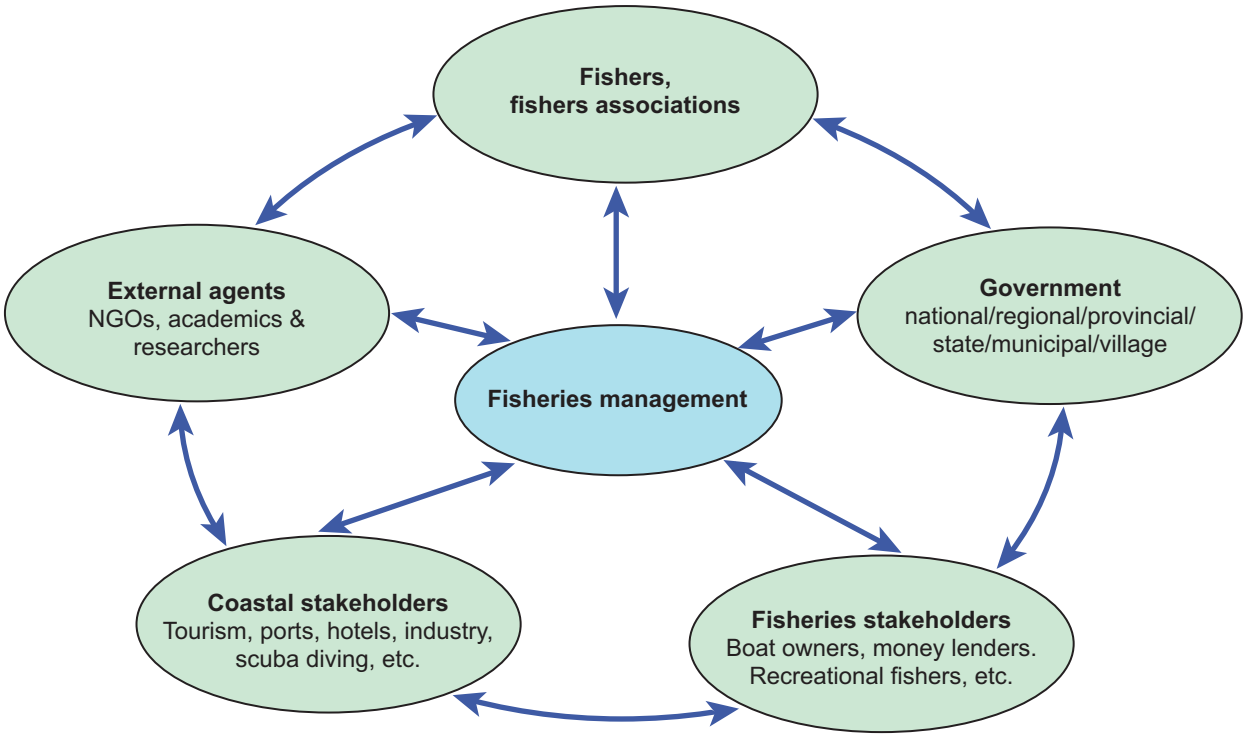


Figure 6 Key actors in co-management and EAF (after Pomeroy & Berkes, 1997)

Institutional arrangements must be set up and understood by all and should cover both how the relevant actors (stakeholders) will be organized and the rules and regulations governing their activities. For example, in many cases decentralization of management also allows a limited decentralization of fiscal authority giving the management agency the authority to collect revenue/recover costs towards the management of the fishery. The local management agency may have the right to employ enforcement officers or to pursue offenders through the courts.

A key issue for successful (and sustained) co-management in small-scale fisheries is compliance with locally agreed rules and regulations relating to access to the resource (good governance). In many circumstances, a network of committees will be required with representatives of different stakeholders involved at different levels.

Scale of implementation

There are various entry points for the EAF processes. EAF initiatives can be taken at various levels and by different stakeholder groups ranging from: (i) a single community or a group of communities wishing to improve the management of inshore fisheries; (ii) a government deciding to adopt EAF in its fishery policy; or (iii) a regional body wanting to develop high-level management of shared stocks at an LME scale. This requires the EAF to cater for both bottom-up and top-down processes.

Ideally, a nested structure for fisheries management should be set up to include fairly large-scale regional seas (e.g. the Bay of Bengal), for which integrated management plans would be developed by a regional advisory council and serve as the basis for centralized decision-making. These large regions could be subdivided into high seas and national EEZs, and, if appropriate, more locally, e.g. where local districts could serve as the basis for devolved management. The existing LMEs form a natural boundary for such a nested system and LME projects could be more orientated to meeting this ideal and forming the necessary linkages between the region as a whole and the local stakeholders.

EAF for inland fisheries

EAF is just as relevant and appropriate for inland fisheries as it is for marine fisheries. Because it covers all the social, economic and ecological aspects of fisheries it can easily be applied. In an inland fisheries setting where the impact of habitat changes on fisheries is often important, the priority setting process will recognize this as an issue of high risk and will allow management interventions to address it.

In fact, EAF can also be applied to aquaculture where the same constraints of focusing just on the target species being cultured and ignoring ecosystem effects are common. By making EAF operational (see next section), better management of inland fisheries and aquaculture can be achieved.

Ecosystem approach to aquaculture (EAA)

An ecosystem approach to aquaculture uses a similar planning framework to the EAF and is a strategy for the integration of the activity within the wider ecosystem in such a way that it promotes sustainable development, equity, and resilience of interlinked social and ecological systems. This definition essentially recalls the ecosystem-based management proposed by the CBD and also follows recommendations of the CCRF. An EAA should be guided by three key principles:

- Aquaculture should be developed in the context of ecosystem functions and services with no degradation of these beyond their resilience capacity.
- Aquaculture should improve human-well being and equity for all relevant stakeholders.
- Aquaculture should be developed in the context of (and integrated with) other relevant sectors. Three scales/levels of EAA application have been identified, namely the farm, the water body and its watershed/aquaculture zone, and the global, market-trade scale.

The adoption and implementation of EAA is necessary to guarantee aquaculture's contribution to sustainable development. More information on the EAA is available in the publication on *Building an ecosystem approach to aquaculture* (FAO, in press).

The planning and implementation of an EAA strategy follows a very similar pathway to EAF, with the five steps (scoping, identifying and prioritizing issues, developing a management plan, implementing and enforcing). In some cases, a broader and more relevant exercise may be required, namely stating high level policy goals. Another necessary prior exercise is to define whether the planning and implementation of the strategy will cover the whole aquaculture sector of a country/region, or (more typically) will address an aquaculture system or aquaculture area in a country/subregion.

Although some of the issues typically identified by the ecosystem approach to aquaculture are similar to those for the ecosystem approach to fisheries, such as community well-being and governance, other issues are very different. This is primarily because in many cases aquaculture is adding nutrients into the environment, is based in a fixed location where impacts can accumulate over time, and is a new industry that is still growing rapidly and competes with other established sectors for resources.

MAKING EAF OPERATIONAL

Integrating fisheries management with integrated coastal/catchment management

EAF requires coordination, consultation, cooperation and joint decision-making, not only between different fisheries operating in the same ecosystem or geographical area, but also between the fisheries management agency and the other sectors that have an impact on fisheries or are effected by fisheries (Figure 7).

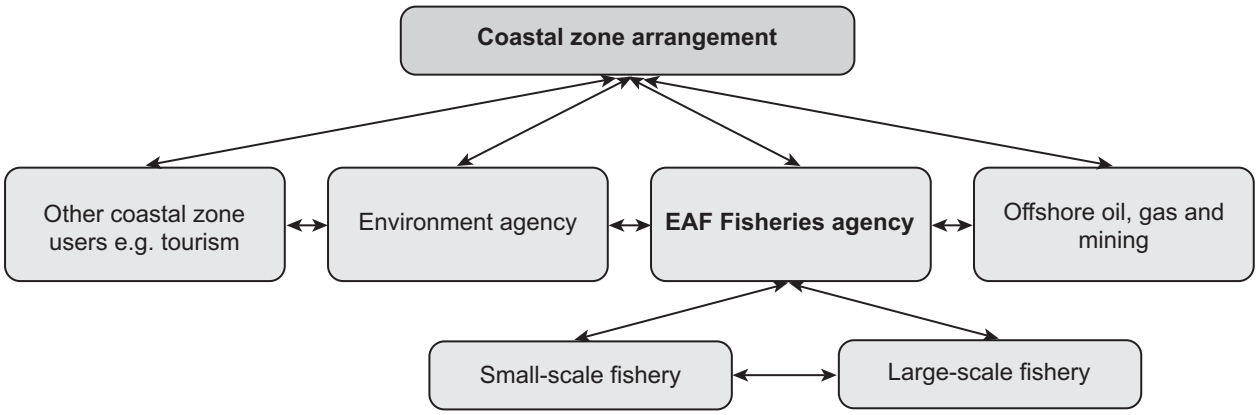


Figure 7 An ideal inter-agency cooperation and consultation ICM framework (redrawn from FAO 2005)

However, in many parts of Asia an ICM framework and institutional arrangements do not exist. In these cases, it is important that the fishery agency takes the lead to consult with other relevant agencies, especially during the planning phase.

At a more local level, activities and agencies responsible for these different activities are often much better integrated than at the national or even provincial levels where ministries and departments are usually organized along sectoral lines. At the local level, therefore, it is often easier to implement EAF, especially if one local government is concerned with all aspects of the livelihoods of local communities.

The key to EAF – an effective management system and good planning

EAF requires setting up some form of a fisheries management system that allows a systematic cycle of planning, implementing and monitoring. In general, it will be the fishery agency that will build this capacity and initiate the process in cooperation and consultation with other agencies and major stakeholders (including non-government organizations (NGOs).

An essential component in adopting EAF is to develop an EAF co-management plan. Because of the different time scales involved in the process of developing and monitoring a management plan, it may be necessary to have at least two components to the plan, e.g. a **higher level strategic plan** that states the broad management objectives and measures to achieve them (reviewed on a three to five-year cycle), an **annual plan** (reviewed through an annual cycle) to cover setting and reviewing specific objectives, indicators and performance measures.

Box 5: Back to basics

It is necessary to get back to basics – first identify the real problem and then fix it. For example, bycatch in itself is not a problem that can be fixed by management. However, one specific bycatch issue, for example the capture of vulnerable and protected species can be addressed by management.

Over time, as objectives become more stable, these latter could be formally included in the higher-level plan. Both are important, although past experience has shown that although many fisheries have a higher level strategic plan, this is often not taken down to the operational level.

As with many of these processes, the act of going through the consultative process to develop the plan is just as important as the output itself. It engenders ownership of the plan, trust of other stakeholders and starts to build up a sound working relationship between players. It also allows roles and responsibilities to be clarified and can form the link between major players such as research institutes, fishery agencies and fishers, thereby making the work of each more relevant and applied to address the needs of the end-users.

A template for a fishery co-management plan that incorporates EAF elements is given in Appendix 1.

Developing and monitoring a co-management plan – six steps

Six steps are required to apply EAF (Figure 8).

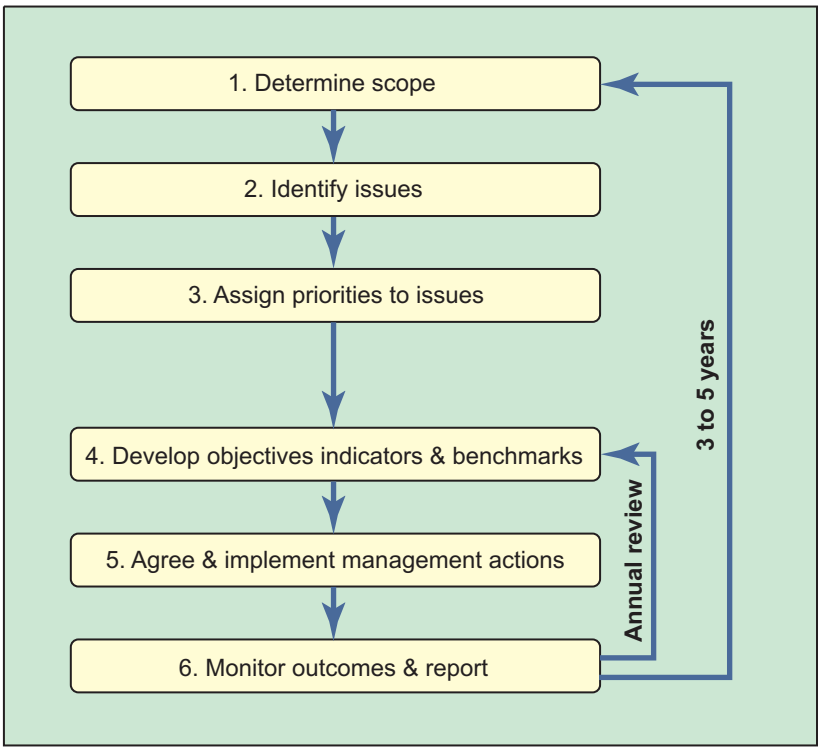


Figure 8 Six steps needed to develop an effective fisheries management plan (from FAO 2003)

Step 1: Scope the fishery – identify the fishery characteristics, its area and stakeholders

The first step in developing an EAF co-management plan is to identify the fisheries management unit (FMU) that will form the geographical basis for the plan. Ideally, the management unit will coincide with a clearly and precisely defined ecosystem. However, ecosystems are not usually clearly defined entities with unambiguous boundaries, and they may cross or be contained within existing fishery management areas. The final choice of FMU and geographic area for a management plan will depend on a number of factors, but at the very least it should cover all harvesting subsectors, both small-scale artisanal and large-scale industrial.

Step 2: Identify the issues in the fishery

Broad issues and policy goals: The next step is for stakeholders to undertake an initial evaluation of issues associated with the fishery. This should cover economic, social and ecological considerations and be guided by the high-level policy goals set at the national or regional level. Identifying issues and finding solutions is best done during a meeting/workshop where all relevant stakeholders are gathered. It is important to get input from as many people as possible. If fewer people are involved at this stage this increases the chances of some issues being missed and also reduces subsequent "ownership" of the process. The process can be made very interactive with a few basic media aids or drawing on paper and clip boards or using pictures.

Break down broad issues into more specific issues: Starting with each broad issue, these are further divided into more specific issues that can be tackled through a management intervention of some sort. The use of component trees allows the issues to be put into a structured framework for subsequent risk analysis and prioritization (Figure 9). Several useful frameworks and tools for guiding this process have been developed (see Appendix 2 for a worked example).

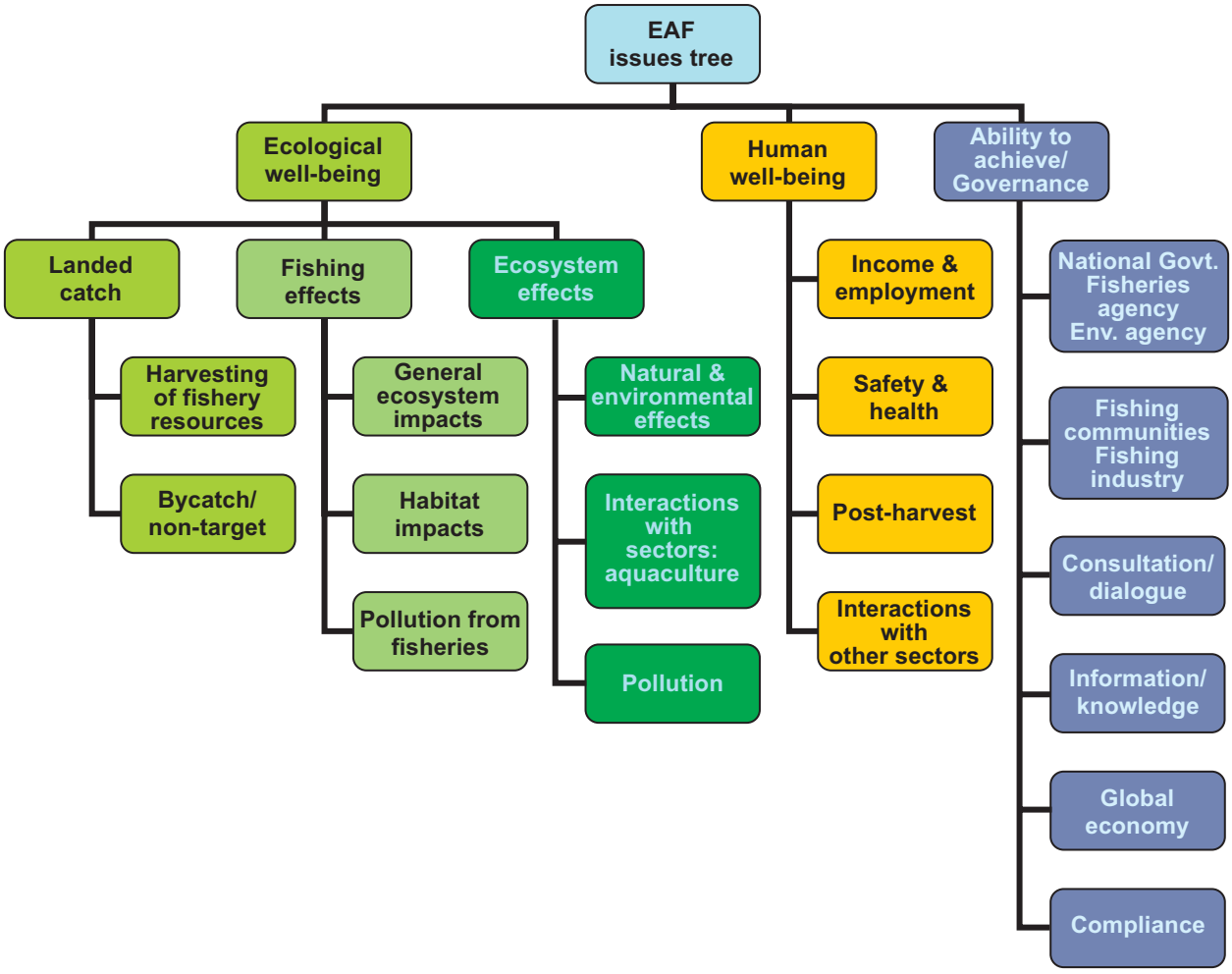


Figure 9 Example of a component tree covering the identified issues in a fishery

Step 3: Prioritize the issues through a risk assessment

This process is likely to result in many potential issues but there is a practical limit to how many issues can be dealt with by a management system. One approach to prioritization of specific issues is to conduct a risk assessment. The risk assessment can be either qualitative and opinion-based, or highly quantitative and data-based. There are many ways to carry out a qualitative risk assessment. One example would be to score both the likelihood and consequences of failure (impact) in relation to each issue on a scale of, say, 0 to 5. High-priority issues are those with a high likelihood of occurrence and high impact. Table 2 provides a guide to the assessment of consequence and likelihood of a particular identified risk, which allows an overall risk value to be determined.

Table 2 The different levels of consequence (C) and likelihood (L) used to calculate the risk value (Risk = Consequence x Likelihood)

Consequence (impacts)		Likelihood	
Level	***Description***	***Level***	***Description***
0 – Negligible	Very insignificant, probably not measurable against background variability.	1 – Remote	Insignificant probability of occurring.
1 – Minor	Possibly detectable but minimal impact.	2 – Rare	May occur in exceptional circumstances.
2 – Moderate	Maximum acceptable level of impact.	3 – Unlikely	Uncommon, but has been known to occur either here or somewhere comparable.
3 – Severe	Above acceptable limit. Wide and long-term negative impacts.	4 – Possible	Evidence that it could occur.
4 – Major	Very serious, likely to require long restoration time to undo.	5 – Occasional	May occur.
5 – Catastrophic	Widespread and probably irreversible.	6 – Likely	Expected to occur.

A risk analysis typically seeks answers to four questions:

1. What can go wrong? (Risk)
2. How likely is it to go wrong? (Likelihood)
3. What would be the consequences of it going wrong? (Consequence)
4. What can be done to reduce either the likelihood or the consequences of it going wrong? (Action).

Step 4: Set objectives, indicators and benchmarks (performance measures)

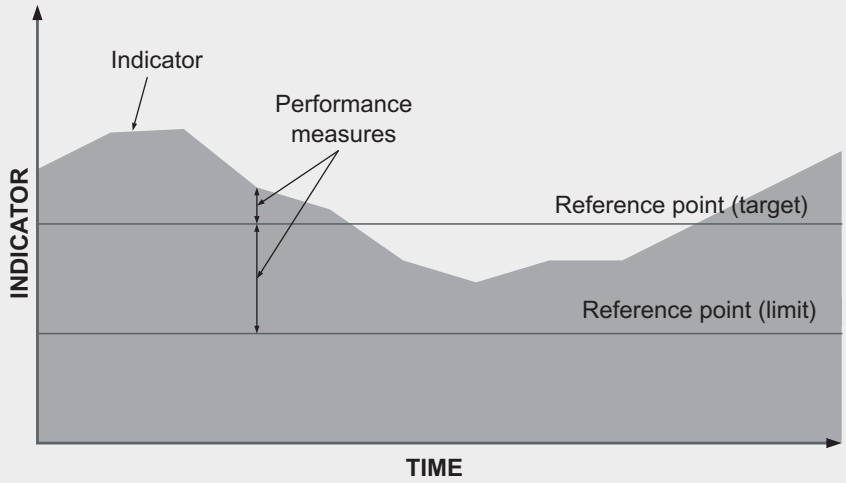
All specific issues should be dealt with in the co-management plan, but in a manner commensurate with the related risk. High-risk issues are elaborated into detailed objectives. Some medium-risk issues might require identification of a mechanism in the plan for ongoing review and some form of contingency plan. Low-risk issues might be noted in the plan, explaining why they are considered low risk.

If the specific issue has been well articulated, it should not be difficult to create an objective related to how to address it. This needs to state what will be achieved in a general sense, *e.g. minimize the impact on turtles.* The stakeholders will also then need to decide on how to assess whether the objective is being achieved. This is done through setting indicators and benchmarks.[1] (see Box 6 for definitions). In practice it should be possible to estimate the indicators from data that have or could be collected, but this should not exclude an indicator for which new data are required.

[1] Indicators not linked to objectives and benchmarks cannot form a valid means of assessing management performance or making decisions. Some indicators may increase over time and some may decrease but whether this trend is good or bad will depend on what the management is trying to achieve and what the agreed benchmark was.

Box 6: Objectives, indicators and bench marks

Indicators and benchmarks are developed only after an objective has been agreed. An indicator tracks the key outcome identified in the objective and, when compared with an agreed benchmark (often a target or a limit value or trend), provides a measure of how well management is performing (performance measure).



A performance measure is simply the difference between the indicator value and its benchmark (referred to as reference points in the diagram) at any time of assessment. Benchmarks are often targets that specify the desired state of the indicator, *e.g. 20 percent of area under an MPA* or limits that specify a boundary beyond which it is desirable (or undesirable) to be, *e.g. 50 percent of existing fishing effort*.

The group of objectives, indicators, benchmarks and performance measures provide a means of communication with decision-makers and their ability to make appropriate changes in management.

Step 5: Select management actions to meet the objective

From the wide range of tools contained in the manager's tool box (elaborated in Appendix 3) the most appropriate management intervention(s) to meet the specific objective need(s) to be selected. Often the same tool (e.g. an MPA) can meet several objectives. These can obviously be grouped but, unlike many fishery management processes that simply introduce interventions without first setting objectives, it will be clear to all stakeholders why a particular management measure is being introduced.

Where possible, the use of specific management measures should be accompanied by decision rules on how they are to be applied. The rules state what management action should be taken under different conditions, as determined by its performance. In a small-scale fishery context these need to be pragmatic (e.g. relating to stricter enforcement if a particular measure is not working). The key is to try and agree about what might happen and how to counteract this before it happens. This provides some certainty for all the players and the rules are known and understood. In certain cases, decision rules can be quantitative (e.g. setting catch limits for the species under consideration as pre-specified fractions of abundance, obtained from surveys) or, more commonly, qualitative action (e.g. a certain value of an indicator triggers a decision to bring forward a review of management).

Step 6: Monitor, assess, report and review

Ecosystem approach to assessments: At the simplest level, because specific objectives and indicators have been chosen to cover the gambit of ecological, social and economic issues, assessing the status of each indicator against its benchmark should provide a snapshot of how well management is performing at the ecosystem level.

There are also a number of assessment tools that allow a more integrated assessment. These have recently been reviewed by Paganyi (2007) who compared a number of modeling approaches in terms of their parameters, assumptions and data requirements. A wide range of models are available ranging from whole ecosystem models such as ECOSIM and ECOPATH, multispecies models (some are an extension of single-species models), bioenergetic models and predator–prey models. Some of the advantages, disadvantages and limitations of each were discussed. It was noted, that in general, the models are not yet being used to guide decision-making and management with the rigour currently being applied to single-species models.

Monitoring and review: The co-management plan must also specify regular reviews in which the success of the management measures in attaining the objectives is appraised. These reviews will benefit from data that has been collected by an effective and well-directed research programme and analyzed by appropriate technical experts. Such review should be carried out under guidance from, and making regular reports to, a designated stakeholder group.

Short-term reviews, for example as part of an annual cycle, should make assessments of the status of key stocks, changes in catch composition, assessments of impacts of the fishery for other broader ecological aspects and social and economic assessments.

Longer-term reviews should also be conducted on a regular basis (three to five years). These reviews should include consideration of the full management arrangements including data collection/resource monitoring, comprehensive re-assessment, reappraisal of decision rules and progress towards meeting longer-term objectives. Longer-term reviews may provide evidence that an objective set earlier (e.g. recovery to a certain species abundance level by a particular date) is no longer appropriate.

Management reports based on assessments

The short-term reviews should be summarized in an annual report that is easy to read and digest and that link with the fishery co-management plan. In general the report will contain:

- Objectives
- Status of the indicator
- Performance assessment
- Management implications.

There are a number of tools available to summarize the results. One method is to use indicator “traffic lights” – green if performance is satisfactory, red if not satisfactory and orange to indicate that things are not progressing very well and caution is needed. Another commonly used system is a kite diagram (Figure 10). An excellent example of applying these steps has been provided by Cochrane *et al.* (2007) that demonstrates the process of identifying issues, undertaking risk assessments and then coming up with management options for a number of fisheries in Benguela Current LME.

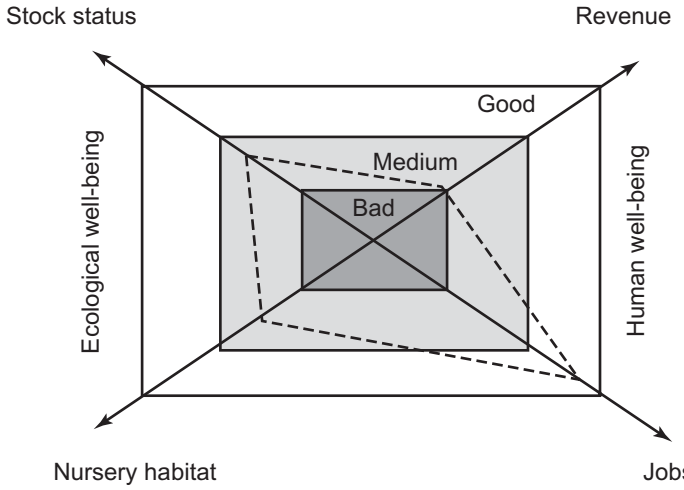


Figure 10 Results of a fishery assessment as indicated by a kite diagram showing ecological, economic and social dimensions. Based on FAO (1999)

EAF/EAA IN THE CONTEXT OF ASIA AND THE PACIFIC REGION FISHERIES

Uniqueness of Asian fisheries

Asia's capture fisheries make up about 50 percent and aquaculture makes up 90 percent of the global production. Although there are often strong claims made about the differences of Asia's fisheries (e.g. their multigear/multispecies nature etc.), in essence all fisheries have similar characteristics, similar issues and similar challenges. The situation is similar for Asian aquaculture. The main difference is that, in general, the challenges are greater in Asia because governments and stakeholders, in many cases, have been slow to adopt sustainable development, in preference to production and wealth creation focused policies.

Asia has the highest proportion of small-scale artisanal fishers and aquaculture farmers in the world, and through mismanagement it is this subsector that is suffering the most. The livelihoods of millions of people are dependent on fisheries/aquaculture, and with few alternatives to supplement their incomes, this suffering is being manifested in boats lying idle along the coasts and ports, high unemployment, lower profits, longer fishing trips (with increased safety risks), and migrations of fishers to find work either within their own countries or overseas, farmers being pushed from their livelihoods by disease issues, rising costs and encroachment of other users.

Key changes to policies

The most significant reform that is needed is a paradigm shift in policy from "production increase" to "increase in benefits (social and economic)". This is at the heart of EAF/EAA. In fisheries, experience from all parts of the world has shown that this can be achieved best in fisheries through moving from "open access" to "limited access". Many of the more developed countries of the region (e.g. Japan, Korea DPR) are already moving in this direction and are capturing the wealth that the harvest and selling of a natural resource such as fish can bring. Other countries (e.g. China PR and Cambodia) are also tackling the twin evil of "production increase" and "open access" by reducing fishing effort through dramatic reduction in fishing vessels in the case of China and introducing community-based rights systems in Cambodia.

Adopting an EAF/EAA approach would be a good way to change policies, especially in those countries where the agriculture paradigm is still firmly entrenched. Any consultative process that looks towards better protection of the environment and a focus on increasing the social and economic benefits of fishing would quickly show the failure of current policies and the need for changes. Because this would come both from the grassroots and from the policy-makers, it would be much more easily accepted by politicians and senior bureaucrats.

As described earlier, the other change that is needed is the development of a management system that fosters the participatory planning, implementation and monitoring of EAF/EAA. Asia has a huge workforce in its fisheries/aquaculture agencies and research institutes that could be mobilized to carry out this change. Unfortunately, much of this workforce is being wasted on providing welfare and unnecessary subsidies, resolving conflicts and disputes, trying to control a monster that is out of control. To add to this mix, many researchers are not linked with the fishery systems and carry out academic research that is of little benefit to anybody. EAF/EAA will potentially assist in bringing the disparate groups together with a common purpose.

Starting the EAF/EAA process at any level is not difficult, although it will require people-orientated and participatory assessment skills not normally found in a fishery officer who is more likely to have been educated in the biological and other sciences. Some human capacity building will be necessary for both fishery officers and other stakeholders, but much of this can be on-the-job training. Simply bringing together stakeholders and discussing issues and solutions is an excellent learning process for all involved. Adaptive management that learns by doing will then provide for rapid human capacity development.

Stakeholder involvement and dialogue

EAF/EAA planning frameworks may appear to be “top down”, but they are actually heavily reliant on the dialogue between stakeholders. The “top down” aspect is the provision of a planning framework and a process initiated by government agencies, however, the development of the plan and its operational aspects is dependent on the input from stakeholders. This will determine the issues, the level of priority attached to them and the ways in which they will be addressed.

There is a strong linkage (interdependence) between the ecosystem approach and co-management as they are largely complementary. The rights and degree of empowerment of stakeholders has an important impact on their ability to engage in the decision-making and planning processes.

The effective inclusion of stakeholders must take into account the ability to participate and ensure that stakeholders are properly identified and measures are put in place to ensure their participation. This is a challenge in the Asian region where farmers and fisheries may not be part of large organizations or federations and their numbers mean that the process of stakeholder dialogue requires significant financial resources and time. The matter of representation of stakeholders may also be a flawed process where political leaders are charged with the levering of benefits from government and to act as an interface between the electorate and the government. This means that there may be filters in the process of dialogue and representation whereby measures or processes that require politically unfavourable outcomes may be distorted or filtered through representatives. This requires a process to ensure that representation is valid and that the small fishers and farmers are adequately represented in a manner that corresponds to their priorities and interests.

Key institutional changes

As discussed above, one of the main institutional changes needed is for a clearer definition of the roles and responsibilities of the different players in the process to be introduced. The other major institutional change is for fishery ministries/departments to take the lead in changing policies and management throughout Asia through applying EAF/EAA. This will require commitment to change and the passion to lead others through this change. Although in many political contexts this will mean taking risks, the fallout from taking these risks will be outweighed by the benefits. The status quo is not an option.

The adoption of an EAF/EAA management approach assumes that there is political will to address the three areas of human well-being, ecological well-being and the ability to achieve. The rapid turnover of high-level policy staff in government and short-term government political terms does limit the long-term strategic implementation of the ecosystem approach to management. This emphasizes the need for longer-term commitment which spans the short-term appointment and three-year planning and budget horizons.

There is often a disconnection between national planning and policy goals and the practical goals and implementation through local government decentralized units. At local levels there is often an emphasis on production increase and income generation and the balancing of this against environmental and governance issues may not be apparent. This calls for a consistency of approach across the levels between national and local levels and reinforces the importance of having an inclusive framework which allows for this harmonization of policy and operational objectives.

Human resources are a critical factor and human resource issues include lack of capacity as well as difficulties of retaining good staff in the government sector. The need for fisheries departments to initiate dialogue challenges their current way of addressing the needs of stakeholders (e.g. participatory stakeholder dialogue can be an unfamiliar way of working).

Legal requirements

Internationally, the instruments for EAF/EAA are mainly contained in voluntary instruments including:

- Rio Declaration on Environment and Development, Rio de Janeiro, Brazil, 1992.
- Agenda 21 of the UN Conference on Environment and Development, Rio de Janeiro, Brazil, 1992.
- FAO Code of Conduct for Responsible Fisheries, Rome 1995.
- Jakarta Mandate on Marine and Coastal Biodiversity, Jakarta 1995.
- Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystems, Reykjavik, 2001.

As a result, few fisheries organizations and national policies and legislation actually make explicit recognition of EAF/EAA, although this is now changing. However, many countries in the region have a legislative framework that does not constrain EAF or co-management. On the contrary, decentralization policies and legislation to support these policies in many countries support EAF/EAA development and co-management.

In the longer term, EAF/EAA may require that existing legal instruments and practices that interact or impact with fisheries be reconsidered, and that adjustments made where necessary. In the future, it may be necessary to regulate the inter-sectoral interactions through primary legislation, e.g. laws controlling coastline development.

The process of making laws and fisheries management plans is also reliant on the underlying legislation that provides the basis for rights and legitimizes the decision-making process. The initiation of planning

by communities can lead to effective local management plans. However, it is important that these are legitimized or placed within broader planning frameworks. If not, there are risks of these local planning actions being undermined by outside forces which lie beyond the power of communities to address within their local systems of management.

Inadequacies in current legislation should not act as a deterrent to getting started with the EAF/EAA process. As issues and management actions are identified, the need for changes in policy and legislation will become apparent and the EAF/EAA process should guide those processes to make the management systems more responsive and effective.

REGIONAL ARRANGEMENTS FOR EAF/EAA

To promote broader adoption and implementation of EAF in the APFIC region, the following regional activities are suggested:

- Launch a media campaign that provides a high level of awareness of the issues and motivates APFIC members to address them.
- Facilitate the building of subregional fishery alliances among countries that share the same regional sea, using existing mechanisms such as SEAFDEC and existing LME projects (these exist for the South China Sea and Gulf of Thailand, Sulu-Sulawesi Sea, Yellow Sea and probably soon the Bay of Bengal).
- Use the subregional alliance to set broad policy goals for their subregions and use them as a way of assisting all participating countries to move forward.
- Assist in building human capacity of staff in fishery agencies at all levels that raises understanding of the causes and consequences of current fishery issues, improves familiarity with EAF/EAA as a solution and, especially for district staff, helps them become more competent to facilitate the EAF/EAA process, especially in using participatory tools (e.g. the hierarchical tree process).
- Assist countries to develop national and provincial (state) strategic fisheries and aquaculture management plans. This would necessitate resolving conflicting objectives, something that has not been really attempted in the past. To highlight conflicting objectives one might ask: Are the fisheries in the subregion being managed to promote wealth generation for a limited number of participants that will flow on to others? Are they being managed to provide increased regional employment? Are they being managed to reduce the poverty of fishery-dependent communities (i.e. pro-poor policies and management etc.)?
- Provide support through the numerous activities that are being undertaken at the local level (including the many co-management pilot projects that are already being funded), to facilitate better planning and EAF/EAA implementation at the local level.
- Set up a regional reporting system based on key indicators of progress that feeds back into APFIC's annual flagship publication *Status and potential of fisheries and aquaculture in Asia and the Pacific*.

It should be noted that many of these activities at different scales could be carried out in parallel, but ideally with strong linkages.

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APPENDIX 1: SUGGESTED ELEMENTS OF A FISHERIES CO-MANAGEMENT PLAN

The following framework could be used as a reporting framework for an EAF plan. It may be used for an entire fishery, but shorter versions could equally be used for sub-units of the fishery. Examples of such sub-units could be:

- geographical areas (often ecosystems cross jurisdictional boundaries such as province or district borders and separate reporting may be easier, with subsequent integration by the national fishery authority);
- discrete parts of the fishery (separate stock, or gear/vessel related parts of the fishery); and
- artisanal, small-scale and industrial fisheries.

Table A1.1 Elements of a fishery co-management plan

TITLE	Name of the co-management area, group or fishery
BACKGROUND	Social and institutional aspects • Area of operation of the fishery, jurisdiction and ecosystem boundaries. • History of fishing and management. • Social and economic benefits, both now and in the future. Description of stakeholders and their interests • Description of other uses/users of the ecosystem, especially activities that could have major impacts, and arrangements for coordination and consultation processes. Consultation process leading to the plan • Ongoing consultative arrangements. • Details of decision-making process, including recognized participants. Descriptions of fishing activity, resources and the ecosystem • Description of resource (target species and byproduct). • Description of the aquatic ecosystem in which the fishery occurs. • Description of fleet types or fishing categories. Ecological issues and challenges • Details of critical environments, particularly sensitive areas • Details of bycatch concerns including threatened/protected species. • Details of other environmental concerns, including biodiversity and trophic changes.
OBJECTIVES	Objectives, benchmarks and performance measures for the fishery, covering: • Fishery resources. • Environment (including bycatch, habitats, prey protection, biodiversity, etc.). • Social aspects. • Economic aspects.
MANAGEMENT MEASURES	• Agreed measures for the regulation of fishing to meet all objectives within agreed time frame, including bycatch, habitat protection, prey protection, etc.
DECISION RULES	• Pre-agreed rules for applying management measures (if possible).

TITLE	Name of the co-management area, group or fishery
ACCESS RIGHTS	• Nature of rights granted in the fishery and details of those holding the rights.
EVALUATION OF MANAGEMENT	• Most recent status of resources including, critical bycatch species, using agreed indicators and performance measures. • Status of the aquatic ecosystem, using agreed indicators relevant to essential objectives and performance measures. • Social and economic analyses using agreed indicators and performance measures.
MONITORING, CONTROL AND SURVEILLANCE	• Arrangements for ongoing monitoring, control, surveillance and enforcement.
COMMUNICATION	• Communication strategy. • Details of any planned education and training of stakeholders.
REVIEW	• Date and nature of next review(s) and audit of performance of management.

APPENDIX 2: MAKING EAF OPERATIONAL – A WORKED EXAMPLE

Integrating fisheries management with integrated coastal/catchment management

For this example, Manila Bay was chosen because it had already been selected as a site for ICM as part of the GEF/UNDP/IMO PEMSEA regional programme. In this respect, it may be atypical of many parts of Asia, but it does demonstrate an excellent example of how EAF can be implemented. However, in other areas where ICM is not so developed, the steps are the same, but the fishery agency has to set up the cooperative and consultative links in building the EAF plan and implementing it. In many cases, other agencies will already be carrying out some of the work under their own mandate, and especially in the case of environmental agencies will be aligning well with EAF objectives, such as habitat protection and restoration etc.

In Manila Bay, several partners including national government agencies, local government units, private sector, academics, indigenous communities, NGOs, religious organizations, farmers, fisherfolk and fishing communities have all worked together to develop the Manila Bay Coastal Strategy that outlines the threats and risks to Manila Bay and proposes a number of strategies to respond to these. This includes risks associated with overfishing and a strategy to achieve sustainable fisheries. Actions include: (i) integrating fisheries management into coastal management at the local government level; (ii) promoting diverse and innovative approaches to fisheries management involving commercial, municipal and recreational fishing; and (iii) implementing no-take fisheries protected areas.

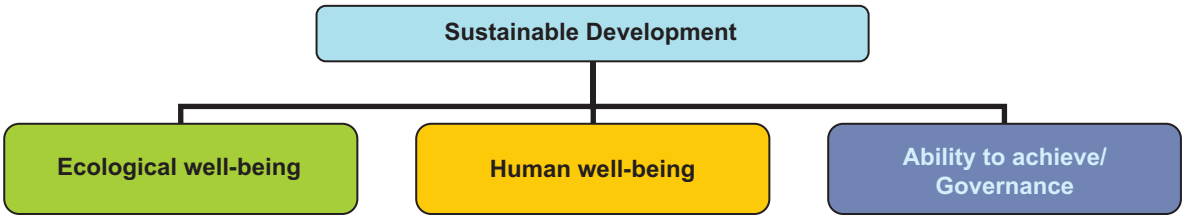

Figure A2.1 The top level of the hierarchical tree framework for identifying major issues and broad management objectives for a given fishery

Developing fishery co-management plans

In this example, as a framework to facilitate discussion and decision-making, the hierarchical tree approach, which has been adopted in Australia and tested in several other countries, is used. The strength of this approach is that it deals explicitly with the hierarchy of issues and objectives inherent in fisheries management that are consistent with achieving sustainable development, thereby linking them with higher-level policies and principles.

The hierarchical tree starts with the two main concerns of sustainable development, namely human well-being and ecological well-being, but it also includes management capacity by adding a third component related to the ability to achieve (includes governance and environmental impact on the fishery) (Figure A2.1). See Figures A2.2 and A2.3 for lower levels referring to specific issues and operational objectives.

Step 1: Scoping the fishery – identifying the fishery characteristics, its area and stakeholders

The fishery management unit (FMU) chosen in this example is Manila Bay. The Manila Bay Coastal Strategy 2001 identified a number of risks and challenges to the future of the bay. These include water pollution, solid waste disposal, overexploitation of resources, siltation and sedimentation, habitat degradation, natural hazards, sea level rise, and multiple-use conflicts. All these impacts have a transboundary dimension in that a major problem in one municipality or city is a threat to the entire bay area. For example, no single body exercises control over the fisheries of the bay and each municipality is responsible for the fisheries in a zone extending 15 km from its shore. This allocation of responsibilities, however, has resulted in overlapping jurisdiction amongst municipalities making coordination and harmonization essential.

The FMU includes a wide variety of fishing gear including otter trawl, bag net, hook and line, beach seine, gill nets, pushnets and fish corral. Major stakeholders for the bay include: (i) the national fisheries agency – the Bureau of Fisheries and Aquatic Resources (BFAR); (ii) municipal governments of the districts surrounding the bay; (iii) fishery associations (representatives of both the small-scale municipal fisheries and the large-scale industrial fisheries; (iv) NGOs working in communities in the area; (v) BFAR Fisheries Resources Research Division; and (vi) University of the Philippines, and the staff of the Partnership for Environmental Management of the Seas of East Asia (PEMSEA) working on ICM in the bay.

An overarching committee – the Manila Bay Fisheries Management Committee – comprised of key representatives of the different stakeholders would need to be set up to facilitate the planning, implementation and monitoring of a fisheries co-management plan for the Bay of Manila.

Step 2: Identifying the issues in the fishery

Broad issues and policy goals: The Manila Bay Coastal Strategy identified a number of fisheries issues that require urgent attention. Overexploitation is seen as a major cause of many problems including depressed incomes for fisherfolk and depleted fish stocks. There is a considerable amount of evidence that this has already occurred with present day catches being based increasingly on juvenile/immature fish and a shift from larger, longer-living species to small pelagic fish and invertebrates.

There is an urgent need to improve the food security and livelihoods of fisherfolk and communities dependent on fisheries. This will require improving the supply of fish (especially higher value commercial species) through improved fishery management and making better use of the fish that are caught. The focus should be on increasing the value of the fishery, rather than increasing production *per se*.

Based on this initial work and a subsequent (hypothetical) workshop with the major stakeholders, the major issues included:

Ecological well-being

- high level of illegal fishing in municipal waters;
- overfishing of the main commercial species resulting in depleted fish resources;
- degraded critical habitats;
- ecologically damaging discarding of bycatch, especially endangered and vulnerable species; and
- detrimental impact on the structure, processes and functions of the ecosystem.

Human well-being

- overcapacity of fishing;
- loss of potential wealth and resource rents through overexploitation;
- declining profits and increasing competition in the race for fish;
- increasing conflict between users both within the fishery and outside of the fishery;
- high levels of poverty and unsustainable livelihoods; and
- high regional unemployment.

The component tree framework in Figure A2.2 illustrates the identification of the issues. It is worth noting that some issues may be considered as ecological issues or human well-being issues (e.g. overcapacity). As with all categorization schemes, overlaps and unclear placement of some components will occur. This is not a problem as long as the issue is recognized and included somewhere in the framework.

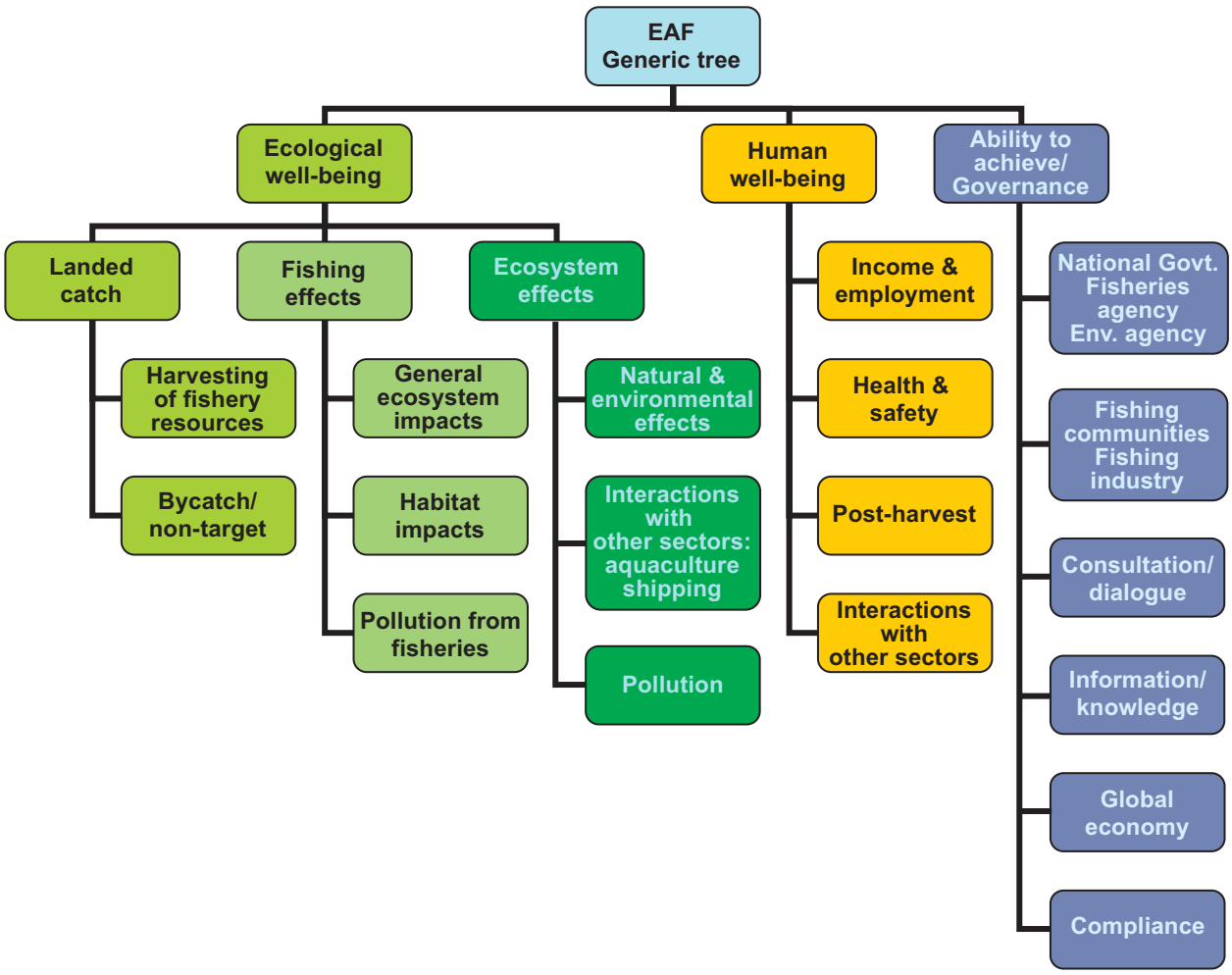

Figure A2.2 The full issue component tree framework for identifying major issues and broad management objectives for the case example

These issues can easily be converted into broad level objectives that could be the basis of a high level strategic plan:

Ecological well-being

- reduce overcapacity of fishing;
- minimize illegal fishing;
- maintain habitats and populations of non-retained (bycatch) species within ecologically viable levels; and
- keep impact on the structure, processes and functions of the ecosystem at an acceptable level.

Human well-being

- increase the wealth generated from the fishery and increase resource rents;
- increase profits and decrease competition in the race for fish;
- reduce conflict between users both within the fishery and outside of the fishery;
- reduce poverty and provide for a more sustainable livelihood; and
- promote reduction of high unemployment in the region.

In Figure A2.3 the category "ecological well-being" was first divided into "landed catch" and "discarded catch". For the landed catch, the main commercial species were then separated out from the less important species and "trash" species. Two specific issues relevant to the broad issue of overfishing of the main commercial species in the landed catch were identified:

(i) spawning stocks declining to a level that impairs recruitment; and
(ii) too many juvenile fish being taken.

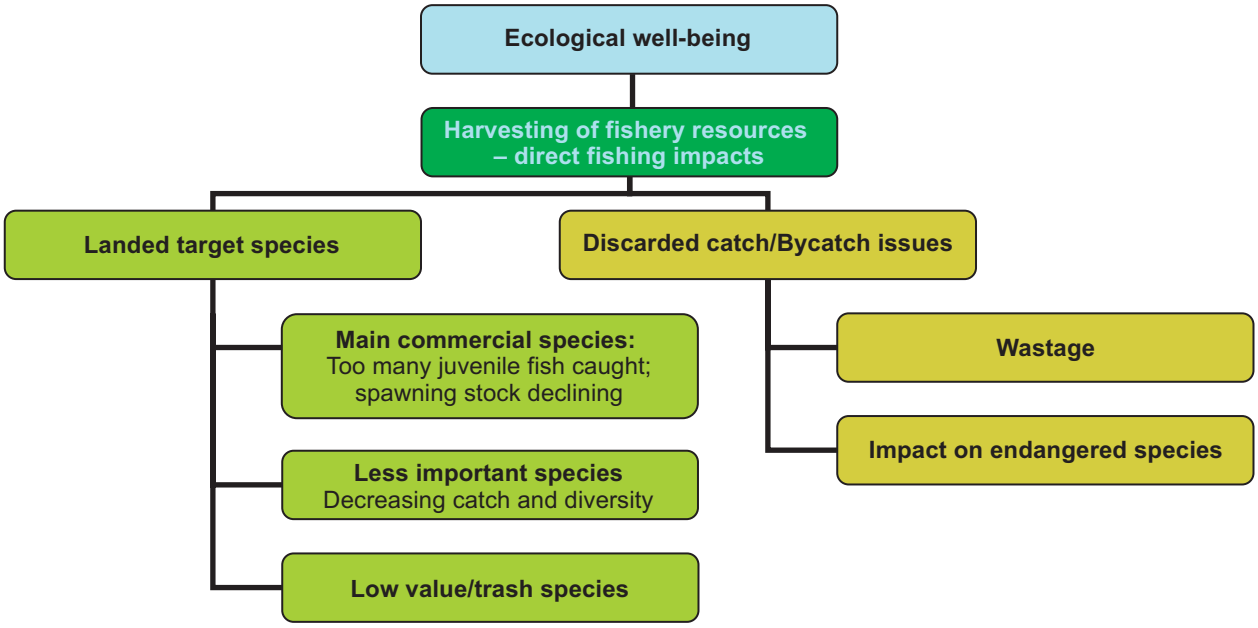

Figure A2.3 Demonstration of how the hierarchal tree can be used to translate broad issues into operational issues that can be converted to operational objectives that management can address

By a similar process, other broad objectives might be translated into specific issues against which operational objectives can be set, such as minimizing the catch of selected vulnerable or endangered species, maintaining the unfished level of identified critical habitats, and achieving a net economic return on capital that is comparable to that for other nominated industries. (A generic template of a hierarchical tree for a capture fishery can be found at http://www.fisheries-esd.com/c/implement/implement0200.cfm).

Step 3: Prioritizing the issues through a risk assessment

The risk assessment process concluded that the two specific issues were judged as high impact/high likelihood and considered important enough to set operational objectives (see Table A2.1).

Table A2.1 Risk assessment process for prioritizing issues

	Issue	Risk		
	ECOSYSTEM ISSUES*	**Con-sequence**	**Like-lihood**	**Risk Value**
LANDED TARGET SPECIES				
High value component	Depletion, declining catches	4	4	**16**
Mixed species	Decline in landed species	4	4	**16**
	Increased catch of juvenile fish of commercial species			
DISCARDED CATCH/BYCATCH ISSUES				
SPECIAL SPECIES *(e.g. listed by CITES, IUCN etc.)*				
Sea turtles/sharks	Catch of endangered species by fishing gear	3	4	**12**
ECOSYSTEM *(e.g. habitat, overall structure and functioning)*				
Trophic level changes	Changes in species composition/structure	3	4	**12**
Dynamite/cyanide fishing		3	4	**12**
Habitat destruction	Bottom trawling	2	4	**8**
Lost gear (ghost fishing)				
Other pollution	Antifouling (fishing boat), waste disposal (oil), fish processing			

* *Impacts of activities on the ecosystem.*

	Issue	Risk		
	COMMUNITY WELL-BEING**	**Con-sequence**	**Like-lihood**	**Risk Value**
FISHERS (and fish processing)				
Income	Income from fishing declining	4	4	**16**
Work related	Safety of operations			
Food	Food security and nutrition	2	2	**4**
	Food poisoning/safety (e.g. algal bloom)			
Gender	Loss of work opportunities			
Employment	Gender issue	4	4	**16**
LOCAL COMMUNITY (Non-fishery)				
Food security health	Access to food, food security and nutrition	2	2	**4**
Interaction with other sectors	Tourism, industry			
Employment	Gender issue	4	4	**16**

** *Issues relevant to the community of stakeholders.*

	Issue	Risk		
	ABILITY TO ACHIEVE (GOVERNANCE + EXTERNAL DRIVERS)* **	**Con-sequence**	**Like-lihood**	**Risk Value**
INSTITUTIONAL				
(e.g. legal framework, management plan, compliance, monitoring and research, availability of resources)				
Policy and regulatory	Coastal strategy – in fisheries			
Management plan	(CRM plans are available at the local level)			
Compliance	Compliance and law enforcement issues	4	4	**16**
Monitoring and reporting	Difficulty of monitoring and reporting			
Human resource capacity	Lack of fishery officer at the local level			
Financial resources	Poor allocation of financial resources	2	3	**6**
Institutional building	Need for capacity building			
Local management	Traditional management system (Sasi, Panglima laut)			
CONSULTATION				
(e.g. existence of adequate process for stakeholder consultation)				
Industry (councils)	Coordination and fisheries councils			
Community	Fisheries management councils			
Inter-agency	Lack of coordination and voice of fishermen	2	2	**4**
Research	Link research to management, use of traditional knowledge	4	2	**8**
Politics	Limited power, jurisdictional overlaps			
Conflicts	Conflicts between small-scale and large-scale fishers	3	3	**9**
Institutional mechanisms	Lack of regular consultative mechanisms			
EXTERNAL DRIVERS				
(e.g. coastal development, pollution, climate change etc.)				
Climate change	Sea level rise (based on current studies)	2	1	**2**
Red tides (algal bloom)	Fish kill			
Transport sector	Pollution and waste disposal, ballast water (exotic species)			
Typhoons	Intensifying and increase in frequency			
Industries	Pollution	4	4	**16**
Human settlements	Organic pollution			
Aquaculture	Fish escapes	2	2	**4**
	Habitat destruction			
	Pollution			
	Price of aquaculture products competes			
Reclamation	Habitat destruction (mangrove), reduction of fishing areas	2	3	**6**

*** *Issues related to existing management arrangements and to external factors that are not directly under the responsibility of a fisheries management agency.*

Step 4: Setting operational objectives, indicators and benchmarks (performance measures)

Operational objectives for the two specific issues relating to commercially important species might be expressed as follows:

> **Objective 1:** To maintain the spawning stock of the commercial species above a percentage of the estimated un-fished level.
>
> **Objective 2:** To reduce the ratio of juvenile fish to adult fish to an agreed amount.

The obvious *indicator for the first objective* is the size of the spawning stock of key commercial species. Manila Bay has had a long series of trawl surveys carried out annually from the late 1940s until at least the late 1980s and it should be possible to estimate the relative size of the spawning stock of key species from these data. It is not known whether the surveys have been continued, but if not, a worthwhile research effort would be to repeat the survey approximately every two years.

The *benchmark could be to set a precautionary limit* for the spawning biomass not to be below 30 percent of that recorded in early surveys in the 1940s.

For the *second objective, the most obvious indicator* is the ratio of juvenile to adult fish in the catch. A *practical benchmark limit* would have to be reached by negotiation but could be in the order of 10 to 15 percent (ideally it would be zero). This information is summarized in Table A2.2.

Table A2.2 Examples of objectives, indicators and benchmark and performance measures

Indicator	Benchmark and performance measure
Objective 1: Relative abundance and biomass of the spawning stock of key prime species.	**Objective 1:** Spawning stock above 30 percent of its un-fished level. This is an accepted international standard for relatively productive tropical species.
Objective 2: Percentage of juveniles in catch.	**Objective 2:** Juveniles forming less than 10 to 15 percent of the species catch.

Step 5: Selecting management actions to meet the objective

Two management actions can clearly address these two objectives, but these would need to be agreed by the stakeholders. The first is to allocate group user rights to local fishing communities and exclude trawling (trawling is currently officially limited to the small area outside of municipal waters but, except for some local policing in some areas, it is not adhered to or enforced). This action would be difficult to implement (strong resistance from a powerful lobby group), but if the main policy is to improve food security and livelihoods of the fishing communities, this might win it sufficient support. Local communities would have to assess their own use of their rights and may choose to reduce fishing effort in order to meet the objective.

For the second objective, some form of more selective gear would have to be chosen and gears catching a large percentage of juveniles either banned or modified. Again, a difficult measure to implement but with time spent in the planning stage, local stakeholders could be convinced of the longer-term benefits. Nevertheless, they might have to be compensated in the short term to make the change.

To implement the measures, details of monitoring, control and surveillance (MCS) would also need to be considered. Ideally, if the buy-in to the plan is good, the measures would be largely self-regulating.

However, this would probably need a separate sub-committee to the main Manila Bay Fisheries Management Committee. Finance would also be a major consideration and a separate sub-committee could be tasked with exploring options for providing the necessary finance, especially through increased resource rents that will accrue as the fishery recovers.

Step 6. Monitoring, assessment and review process

A reporting process would need to be set up with an assessment team made up of fishery scientists, sociologists and economists as well as a fisher association reporting annually to the overarching Manila Bay Fisheries Management Committee. The assessment would base its work on reviewing progress made towards meeting the objectives based on an analysis of the indicators and benchmarks (see Table A2.3). The Manila Bay Fisheries Management Committee in turn would assess the degree to which management actions were, or were not, being effective and implement changes, new approaches etc.

Every three to five years, a major review would be held, preferably by a third party audit, that re-assesses the issues and sets up a revised plan.

Table A2.3 Example of summary assessment report

Performance report heading	Description
1. Reason for inclusion	Two issues were ranked high impact/high likelihood: declines on spawning stocks and increasing percentage of juveniles being caught.
2. Operational objectives	**Objective 1:** To maintain the spawning stock of the commercial species above an agreed percentage of the estimated un-fished level. **Objective 2:** To reduce the ratio of juvenile fish to adult fish to an agreed amount.
3. Indicators	**Objective 1:** Relative abundance and biomass of the spawning stock of key prime species. **Objective 2:** Percentage of juveniles in catch.
4. Benchmark and performance measures	**Objective 1:** Spawning stock above 30 percent of its un-fished level. This is an accepted international standard for relatively productive tropical species. **Objective 2:** Juveniles forming less than 10 to 15 percent of the species catch.
5. Evaluation	**Objective 1:** Regular demersal trawl surveys carried out by BFAR. Results are to be reported directly to new Fisheries Management Committee. **Objective 2:** Regular sampling at selected landing sites.
6. Robustness	**Objective 1:** The indicator is dependent on carrying out comprehensive surveys using good experimental designs. **Objective 2:** The indicator is dependent on good landing statistics.
7. Fishery management response	**CURRENT ACTION** **Objective 1:** Ban on trawling in the bay, and allocation of group user rights to fishing communities. **Objective 2:** Use of more selective gear. **FUTURE ACTION** Will need to review, especially if current measures prove to be unenforceable.
Action if performance not acceptable	• New stricter management measures will be imposed in consultation with stakeholders. May require reduction in fishing effort of small-scale fishers and further restrictions in gear.
8. Other externalities	• Fish populations could be reduced because of increased pollution in the bay. Results of pollution monitoring should be checked by the new Fisheries Management Committee.

APPENDIX 3: OPERATIONALIZING EAA – AN EXAMPLE

Step 1: Scoping the aquaculture system – identifying its characteristics, area and stakeholders

The scoping process includes establishing the relevant geographical scales or ecosystem boundaries and the relevant stakeholders and relevant institutions within each (Table A3.1). It is important to recognize that different issues have different geographical scales in terms of impact. For example, those related with water use and modification of habitats may be relevant at the scale of a single farm or a collection of farms. There may be much broader issues that relate to the sector as a whole, such as collection of wild seed for stocking in the farming system may affect a whole watershed. The issue of use of fish meal in feed will have impacts at a global scale. In this respect the identification of issues and the scoping must go together. It is also important to consider cumulative impacts since aquaculture normally is located in a fixed location in space. The example used here is based on cage aquaculture in a large multipurpose water body (a similar approach could be applied to marine aquaculture cages in coastal bays, or freshwater fish cages based in lakes or reservoirs).

Table A3.1 A stakeholder and institutional identification table

Direct stakeholders	Indirect stakeholders	*Agencies/government actors*
• Cage farmers or owners. • Farm workers. • Local governments. • Small-scale capture fisheries.	• Services: feed people, transport, control the price, support. • Small-scale capture fisheries. • Catchment stakeholders, agriculture, forestry. • Water management people. • Electricity production needs. • Downstream farmers. • Tourism. • Local government bodies. • Money lenders. • Research institutions. • Consumers, including local consumers.	• Water management authority, catchments authority. • Power/irrigation authority. • Joint district authorities. • District authorities. • Environmental agency. • Fisheries and aquaculture institutions. • Community representation. • NGOs.

The problem: The impoundment of three reservoirs left people displaced and without means of livelihood. Part of the mitigation measures for this was the promotion of cage fish farming. Although the scientific aspects of optimum number of cages and cage size were considered there was not enough attention paid to the siting and zoning and overall carrying capacity of the system. Once cage aquaculture started to become lucrative and popular, it attracted increasing investment and interest from outside of the area. Entrepreneurs and investors increased the scale and intensity of the cages in the reservoirs. Within five years the production per cage declined and farmers started to experience fish kills. Although the richer cage farmers could enter other businesses, the original poorer farmers and fishermen did not have other options.

Step 2: Identifying the issues in the aquaculture system

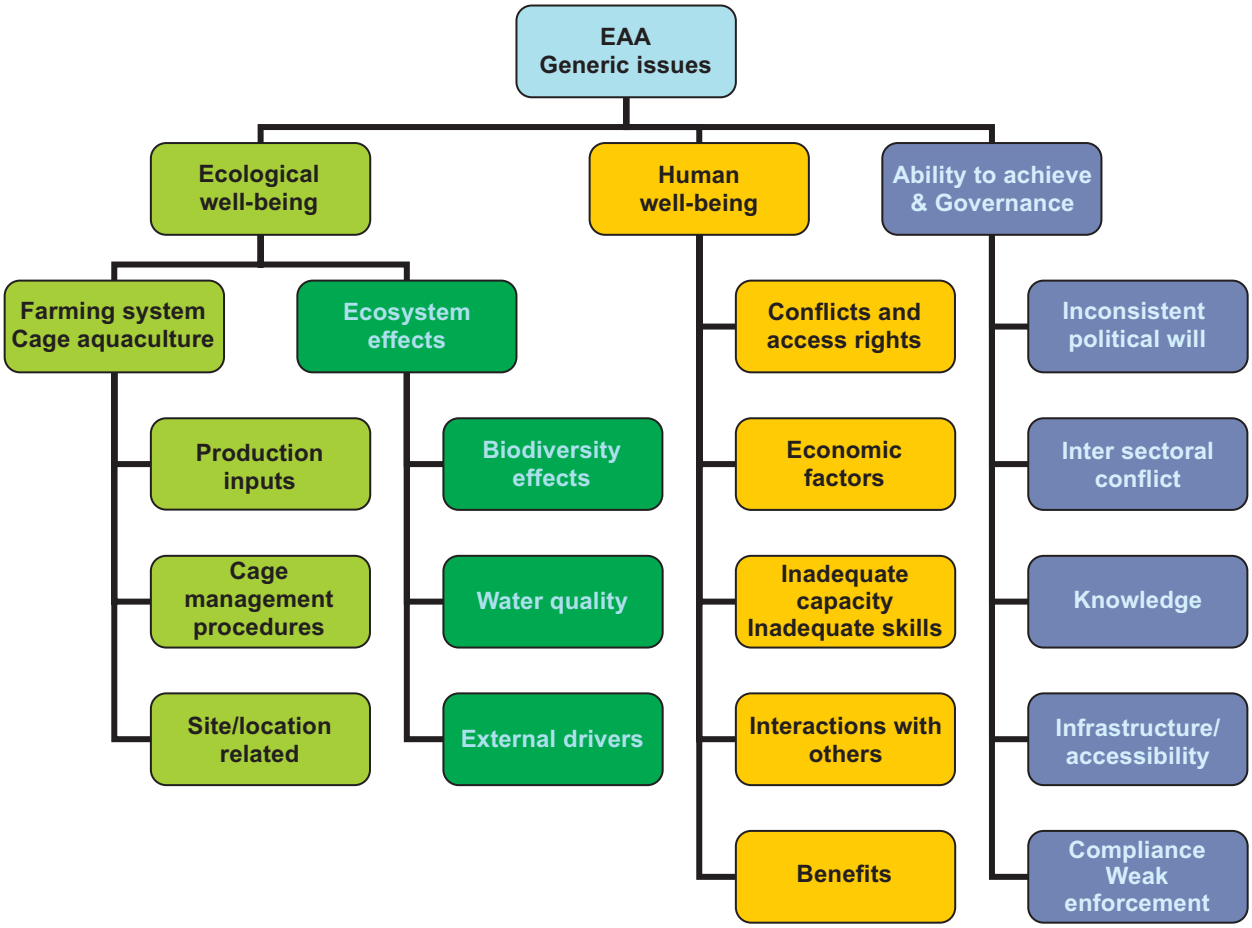

Figure A3.1 An example of a component tree of issues for the fish cage aquaculture system

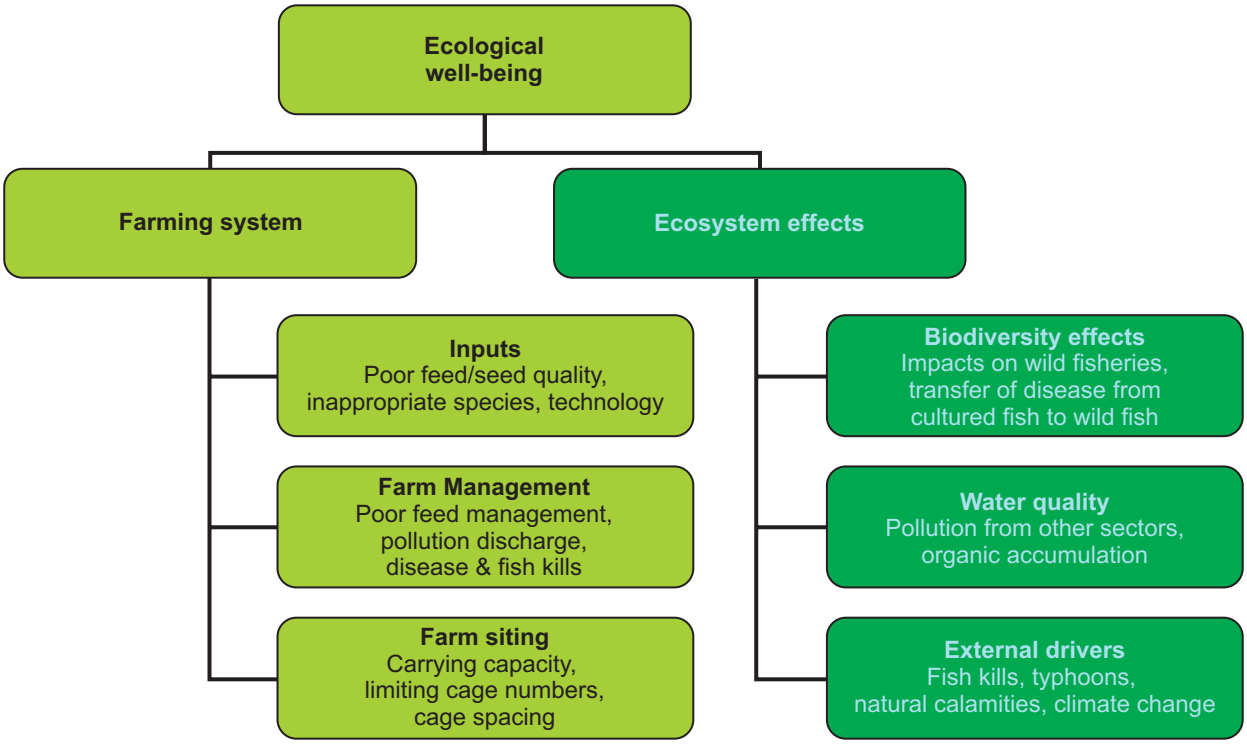

Figure A3.2 Issues relating to ecological well-being

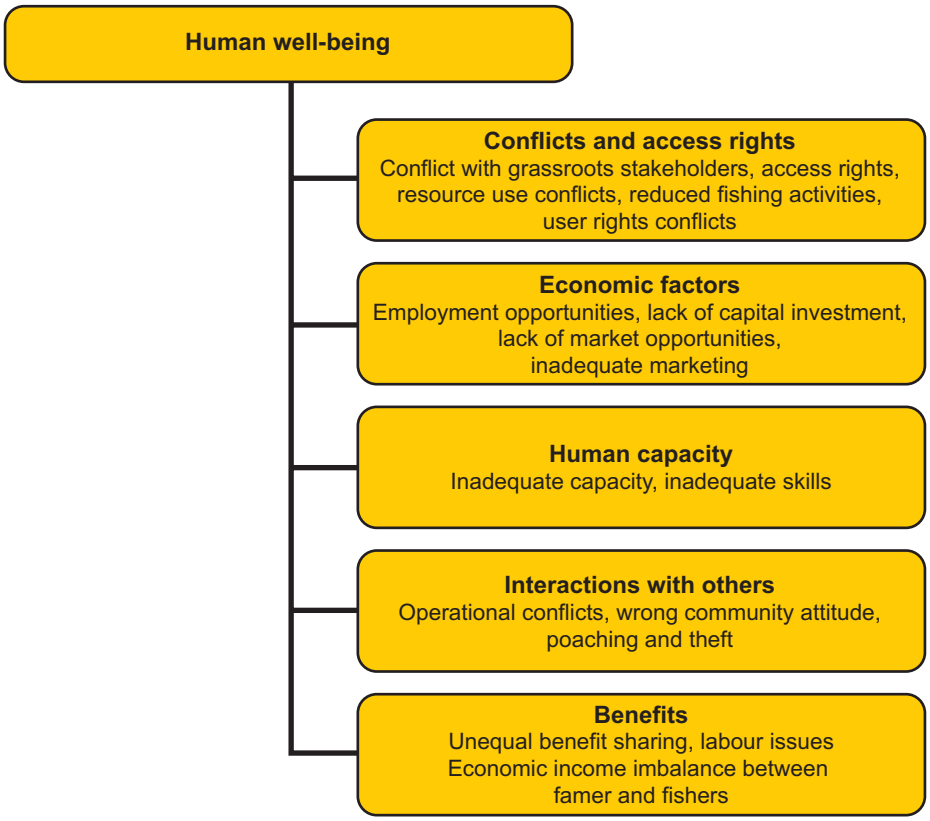

Figure A3.3 Issues relating to social well-being

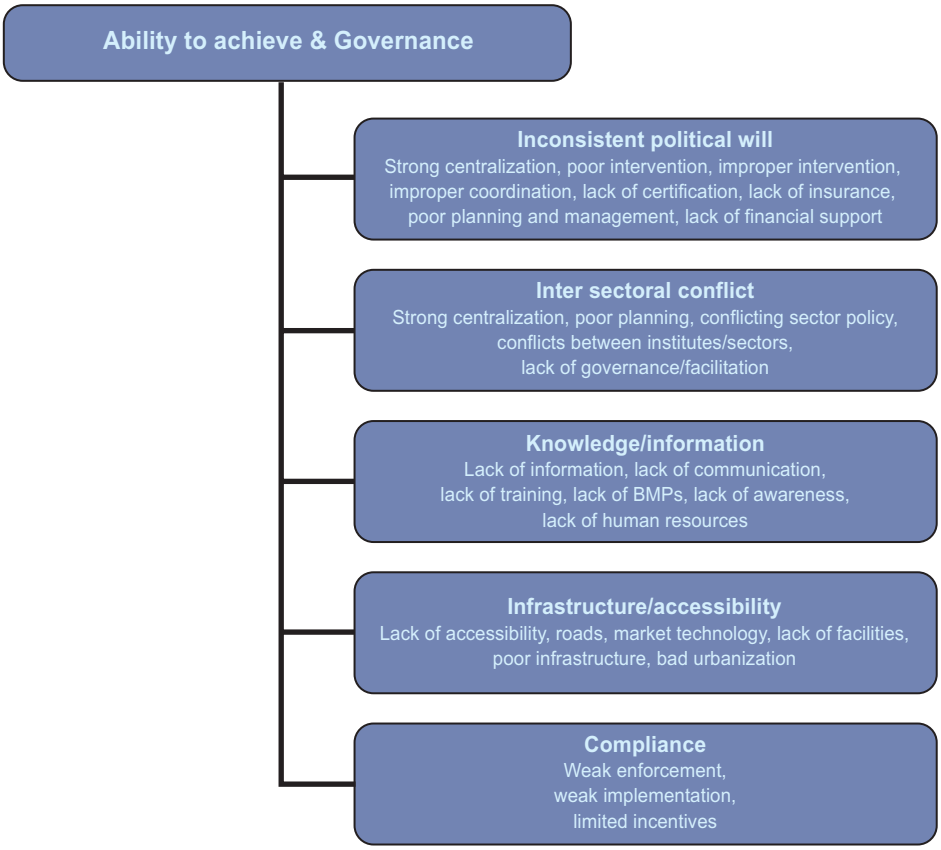

Figure A3.4 Issues relating to ability to achieve and governance

Step 3: Prioritize the issues through a risk assessment

Table A3.2 summarizes the process of prioritizing the issues through conducting a risk assessment. The higher the risk value the greater degree of priority given to that issue.

Table A3.2 An example of prioritizing the issues through a risk assessment

Governance				
Issue	**Description**	**Con-sequence**	**Like-lihood**	**Risk value**
Inconsistent political will	Strong centralization	2	2	**4**
	Poor intervention	2	2	**4**
	Improper intervention	3	3	**9**
	Improper coordination	3	3	**9**
	Lack of certification	3	3	**9**
	Lack of insurance	4	4	**16**
	Poor planning and management	3	2	**6**
	Lack of financial support	3	3	**9**
Inter-sectoral conflict	Conflicts between institutions	3	2	**6**
	Conflict between sectors	3	3	
	Lack of governance, facilitation	3	3	**9**
	Lack of marketing	3	3	**9**
	Inconsistent institutional support	3	2	**6**
	Strong centralization			
	Poor planning			
	Conflicting sector policy			
Knowledge needs	Lack of information	3	3	**9**
	Lack of communication	3	3	**9**
	Lack of training	3	3	**9**
	Lack of BMPs	3	3	**9**
	Lack of awareness	3	3	**9**
	Lack of human resources	3	3	**9**
Infrastructure issues	Lack of accessibility, roads, market technology	3	3	**9**
	Lack of facilities	3	3	**9**
	Poor infrastructure	3	3	**9**
	Bad urbanization	2	2	**4**
EXTERNAL DRIVERS (e.g. coastal development, pollution, climate change etc.)				
Natural	Fish kills	4	2	**8**
	Typhoons			
	Natural calamities			
	Climate change			
Trade Market	Export	3	2	**6**
	Local	2	2	**4**
Exports		3	2	**6**

Ecological				
Issue	**Description**	**Con-sequence**	**Like-lihood**	**Risk value**
Improper Siting	Improper siting of cages	4	3	**12**
	Carrying capacity estimation	3	1	**3**
	Correct bathymetry	1	1	**1**
Water quality	Poor water quality	4	3	**12**
	Pollution from other sectors	3	2	**6**
	Organic accumulation	3	2	**6**
Technology	Inappropriate technology	4	3	**12**
Species	Inappropriate species selection	4	1	**4**
Biodiversity impacts	Impact on natural fishery	2	2	**4**
Poor management	Transfer of disease from cultured to wild	3	2	**6**
	Pollution from the sector	3	2	**6**
Habitat destruction	Habitat destruction	2	1	**2**
Poor feed management	Poor feed quality	3	3	**9**
	Poor seed quality	3	3	**9**
Social well-being				
Issue	**Description**	**Con-sequence**	**Like-lihood**	**Risk value**
Conflicts	Conflict with local stakeholders Access rights Resource use conflicts Reduced fishing activities User rights conflicts Reduced fishing activities Operational conflicts	**3**	**3**	**9**
Economic factors	Economic income imbalance between farmer & fisher Employment opportunities Lack of capital investment Lack of market opportunities Inadequate marketing Unequal benefit sharing Labour issues	**3**	**4**	**12**
Fish health	Fish disease Fish kills	**2**	**4**	**12**
Capacity	Inadequate capacity Inadequate skills	**2**	**3**	**6**
Food safety	Food safety issues	**2**	**2**	**4**
Poaching/theft	Theft from cages	**3**	**3**	**9**

Step 4: Setting operational objectives, indicators and benchmarks (performance measures)

The operational objective set for this case was to restore the water quality of the lake to assure sustainable cage production within three to five years. In doing so, there are a number of linked issues which must be addressed. These are:

- inter-sectoral coordination
- water quality
- conflict between resource users.

These points are illustrated in Table A3.3.

Table A3.3 Example showing how linked issues might be addressed

Indicator	Benchmark and performance measure
Objective 1: Improve inter-sectoral coordination between fisheries and other agencies responsible for water.	**Objective 1:** Fisher & farmers licensing established.
Objective 2: Improve water quality in the lake to sustain fisheries and fish culture.	**Objective 2:** Zoning plan developed, regulations for cage aquaculture developed.
Objective 3: Reduce conflicts between cage farmers and fishermen.	**Objective 3:** Co-management organization functioning.

Step 5: Selecting management actions to meet the objectives

Table A3.4 shows how management actions might meet the objectives when implementing an EAA.

Table A3.4 Management actions broken down by activities

Management action	Activities
Resolve institutional issues related to water body management	• Initiate dialogue with local government to ensure high-level support. • Identify primary agency responsible for water body (dam) management (energy, irrigation). • Negotiate with water body management agency and other agencies (Dept. of Environment) to receive permission for aquaculture or fishing licenses. • Establish fisheries & aquaculture farmer rights.
Initiate co-management organization and planning	• Start management plan. • Stakeholder meeting. • Stakeholder consultation. • Develop co-management plan. • Establish a lake co-management committee.
Establish ecological parameters for aquaculture & fisheries	• Establish carrying capacity parameters and biological loadings. • Once carrying capacity known, develop solutions. • Organize stakeholder meetings. • Establish limits for cage operations. • Promote improved farming practices.

Management action	Activities
Develop lake based regulations	• Regulations. • Lease length. • License/permit issuance. • Control of license numbers. • Stocking density. • Feed type/quality. • Disease free seed/biosecurity.
Establish monitoring and reporting framework	• Establish reporting frame and responsibilities. • Integrate farmers associations and stakeholder groups into reporting where appropriate.
Capacity building & training	• Capacity building for farmers in better management practices • Dissemination of lake based regulations.

Step 6. Monitoring, assessment and review process

A reporting process would need to be set up with an assessment team made up of fishery scientists supported by facilitators trained in participatory evaluation and group organization (these may be resource persons within the agency, or part of another institution's human resource base). The team should also include the cage culture farmers and fishers association/organization. The report (see Table A3.5 for an example of some of the main issues covered) would be made annually to a reservoir management committee. The assessment would review progress made towards meeting the objectives based on an analysis of the indicators and benchmarks. The committee would assess the extent to which objectives had been met and recommend action needed to be taken to resolve issues. Every three to five years the plan would be reviewed (preferably by a third party audit) to re-assess the issues and set up a revised plan.

Table A3.5 Some of the main items covered by a performance report

Performance Report Heading	Description
1. Reason for inclusion	To achieve sustainable cage farming and capture fisheries in the lake; the need to address ecological problems of water quality; the social aspects of conflict between cage farmers and fishermen; the governance aspects that underpin regulation and management of the water body.
2. Operational objective	Bring back water quality of lake to assure sustainable cage production within three to five years • Inter-sectoral coordination • water quality • conflict among resource users. Trade off standards of water quality that allow cage aquaculture but do not compromise primary production of wild fisheries.
3. Indicator	**Objective 1:** Improve intersectoral coordination between fisheries and other agencies responsible for water. **Objective 2:** Improve water quality in the lake to sustain fisheries and fish culture. **Objective 3:** Reduce conflicts between cage farmers and fishermen.
4. Benchmark and performance measure	**Objective 1:** Fishers & farmers licensed. **Objective 2:** Zoning plan developed, regulations for cage aquaculture developed. **Objective 3:** Co-management organization functioning.

Performance Report Heading	Description
5. Evaluation	**Environmental indicators** • Production per unit in cages; fish growth rate; parameters of water quality; fisheries harvest; number of fish kills; number of disease outbreaks. **Social indicators** • Fishers' income levels; reduction in poverty; reported incidence of conflict.
6. Robustness	Coordination and dialogue with other agencies (e.g. Dept. of Environment). Political will of local government.
7. Fishery management response	**Objective 1:** Identify competent authorities (Water/Electricity) and negotiate with water body management agency and other agencies (Dept. of Environment). **Objective 1:** Develop licensing scheme for fisheries and aquaculture. **Objective 2:** Develop plan for zoning, fishing & aquaculture regulations and limiting cage numbers and production intensity. **Objective 3:** Establish an aquaculture monitoring group, a committee for the management of the fishery sector in the impoundment (funded from revenue from licenses or percent of fry cost).
Action if performance not acceptable	• Seek greater support from local government. • Increase resourcing to group organization and strengthening for co-management.
8. Other externalities	• Tourism development may result in pressure to reduce cage numbers further and reduce eutrophication from feed inputs.

APPENDIX 4: FISHERY MANAGER'S TOOLBOX

Based on an analysis carried out by FAO it appears that many of the interventions introduced to manage fisheries are not very effective, especially in the longer term. This applies especially to interventions introduced by regulations in a top-down management style by government. Fishers invariably respond in such a way to reduce the impact of the intervention, so that they can continue to catch more fish. According to FAO, the tools that work best are tools that allocate user rights to the fishers, either as individuals or as groups, such as communities (see Box A4.1 and Table A4.2).

Box A4.1 Rights-based management approaches

A well-defined and appropriate system of access rights in a fishery produces many essential benefits, most importantly ensuring that fishing effort is commensurate with the productivity of the resource and providing the fishers and fishing communities with longer-term security that enables and encourages them to view the fishery resources as an asset to be conserved and treated responsibly.

There are several different types of use rights. Territorial use rights (TURFs) assign rights to fish to individuals or groups in certain localities. Limited-entry systems allow only a certain number of individuals or vessels to take part in a fishery, with entry being granted by way of a license or other form of permit. Alternatively, entry may be regulated through a system of effort rights (input rights) or by setting catch controls (output rights), where the total allowable catch (TAC) is split into quotas and the quotas allocated to authorized users.

Each type of use right has its own properties, advantages and disadvantages, and the ecological, social, economic and political environment varies from place to place and fishery to fishery. Therefore, no single system of use rights will work under all circumstances. It is necessary to devise the system that best suits the general objectives and context for each case, and this system may well include two or more types of use rights within a single fishery or geographic area. For example, a fishery that includes artisanal and commercial fishers could make use of TURFs, effort quotas and catch quotas to regulate access in the different sectors in a way that suits the nature of each, and gives due attention to the productivity of the resources.

In essence, implementing the CCRF through EAF will of necessity require the allocation of rights in most if not all fisheries.

For small-scale fisheries, the main tool will probably be a system of community rights-based management, which protects the rights of access by poor small-scale fishers. This will need to be accompanied by a reduction in fishing capacity of the large-scale fishing fleet, particularly trawlers. This in turn should encourage more responsible fishing practices and the removal of destructive gear and halt dynamite and cyanide fishing. Mesh sizes of existing fishing gear will also have to increase to reduce the catch of small fish, including juveniles of potentially more valuable fish.

Table A4.2 Fishery management toolbox – duration of impact, direct and longer-term effects*

Management Tool [Fisheries resources]	Duration	Direct Effect(s)	Longer-term (mostly adverse) Effects and Outcomes
Gear restrictions **Vessel restrictions**	Temporary	• Initial reduction in harvests.	• Substitution of unregulated inputs or new gear types to replace restricted inputs. • Regulations lose effectiveness and additional regulations required. • Create motives for IUU fishing. • Capacity will increase.
Limited entry programmes	Temporary	• Limit participation.	• Capital stuffing – where a vessel's horsepower, length, breadth, and tonnage are increased – typically occurs. • Drives changes (technological innovations) in gear, in fishing periods or areas. • Create motives for IUU fishing. • Fishing capacity will increase.
Aggregate quotas **Total allowable catches (TACs)**	Temporary	• Likely to accelerate, not reduce, the growth of fishing capacity.	• Capacity and effort increase if effort and entry unrestricted. • Race for fish ("fishing derby") develops. • Potential for frequent overruns of the TAC resulting in overexploitation; frequently result in excess processing capacity and processing plant down time during closed season(s); additional regulations required, particularly to limit discarding and false reporting, ensure traceability and to control transshipment. • Create motives for IUU fishing. • Capacity will increase.
Non-transferable vessel catch limits (individual quotas/IQs)	Temporary	• Overcapacity not addressed. • May limit additional growth of capacity.	• Creates requirement for regulations to ensure traceability and to control transshipment. • Creates requirement for additional regulations. • Create incentive for IUU fishing. • Capacity will increase.
Vessel buyback programmes	Temporary	• Purchase of vessel(s), license(s), and/or gear(s). • Capacity may be temporarily reduced in the fishery.	• Any improvements in stock abundance will attract additional capacity. • Create motives for IUU fishing. • Capacity will increase.

Management Tool [Fisheries resources]	Duration	Direct Effect(s)	Longer-term (mostly adverse) Effects and Outcomes
Individual effort quotas (IEQs) in trawl time, gear use, time away from port, fishing days, etc.	Medium-term only	• Enforcement difficult. • Additional regulations required to control input substitution.	• Capital stuffing – where a vessel's horsepower, length, breadth, and tonnage are increased – frequently occurs. • Creates requirement for regulations to ensure traceability and to control transshipment. • Create motives for IUU fishing. • Capacity will increase.
Allocation of user rights or designated access	Potentially enduring	• Reallocation of the fishery to the recipient community.	• Territorial Use Rights (TURFs). • Management and Exploitation Areas for Benthic Resources (MEABRs). • Limited Access Privilege Programmes (LAPPs). • Designated Access Privilege Programmes (DAPPs). • Requires group understanding of asset value of user rights, capability to manage. • Reduction of overcapacity or containment of capacity linked to subsequent management.
Individual fishing quotas (IFQs) **Individual transferable quotas (ITQs)**	Potentially enduring	• Market forces drive out overcapacity. • Consolidation occurs if overcapitalized.	• Capacity managed automatically, overcapacity does not occur/reoccur. • Compliance concerns internalized by fishers to protect asset (rally against IUU fishing); supplementary regulations helpful to reinforce conservation.
Seasonal and spatial closures (spawning and juvenile habitats, MPAs etc.)	Potentially enduring if of sufficient size	• Reduced time/area for catching fish.	• Creates requirement for effective enforcement and cooperation of users. • May not reduce capacity but can provide refuge for fish.
Ecolabelling	Potentially enduring if based on consumer preferences	• More responsible fisheries to gain price differential.	• Only works in societies where consumers are prepared to pay more for ecologically sustainable fish products, e.g. developed nations. • Can have flow-on effect to exports from developing nations.
Management Tool [Ecosystem]	Indefinite duration	• Direct effect(s).	• Longer-term effect(s).
No take areas, MPAs etc.	Potentially enduring if of sufficient size.	• Protected fish resources and habitats.	• Requires effective enforcement and cooperation of users. • Can provide refuge for fish and critical habitats.

Management Tool [Fisheries resources]	Duration	Direct Effect(s)	Longer-term (mostly adverse) Effects and Outcomes
Habitat modification (e.g. mangrove/seagrass restoration; artificial reefs)	Long-term if based on sound ecology.	• Ownership in management intervention.	• Can slow or even reverse trends in fishery resource declines. • Long term building of mangrove/seagrass dependent stocks back to original carrying capacities.
Restocking and stock enhancement	Long-term if based on sound ecology.	• Ownership in management intervention.	• Can slow or even reverse trends in fishery resource declines. • Long term building of some stocks provided critical habitats have not been removed. • Costs may outweigh benefits in the long term.
Artificial reefs	Potentially enduring if right construction.	• Ownership in management intervention.	• Unsure. Artificial reef may act to increase productivity but also may act as an aggregating device that increases the fishing power of existing gears.
Culling and/or introductions to maintain balance in an ecosystem	Temporary.	• Could be detrimental if opposed by some groups.	• Unsure. Ecosystem response to manipulations very unpredictable.
Management Tool [Socio-economic]	**Duration**	**Direct Effect(s)**	**Longer-term (mostly adverse) Effects and Outcomes**
Short-term subsidies	Should be used only to reduce short-term hardship during transition periods.	• Allows unviable operators to remain in the fishery.	• If allowed to continue, subsidies distort market forces and often results in overcapitalization and overexploitation of fishery resources.
Taxes and royalties (recovery of resource rent)	Indefinite duration.	• Leads to more equitable distribution of benefits. • Market forces drive out overcapacity. • Consolidation if overcapitalized.	• Administratively intensive: requires constant adjustment of tax levels to maintain capacity at desired level • Politically difficult to impose, easier to rescind

** Adapted from Ward et al., (2004)*

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