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Human dimensions of the ecosystem approach to fisheries: an overview of context, concepts, tools and methods

Cover photos: *(from top left, clockwise)*
A woman collects salted fish at a fishing village, Pante Raja Barat, Pante Raja subdistrict in Pidie, Indonesia (FAO/A. Berry). Fishermen in India who lost their homes, boats and livelihoods in the 2004 tsunami try to catch fish with nets in front of boats destroyed during the tsunami (FAO/A. Vitale). A Cambodian fishing village (courtesy of A. Charles). Sunset on the coast of British Columbia, Canada (courtesy of A. Charles). A view of a marina in Mexico (courtesy of A. Charles).

Human dimensions of the ecosystem approach to fisheries: an overview of context, concepts, tools and methods

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Preparation of this document

This overview of social, economic and institutional aspects of an ecosystem approach to fisheries (EAF) was initially prepared to facilitate the work of the FAO Expert Consultation on the Social, Economic and Institutional Considerations of Applying the Ecosystem Approach to Fisheries held in Rome, Italy, from 6 to 9 June 2006. The report was used as the primary background material and source of concepts and references for the supplemental EAF guidelines discussed at the meeting. Comments and additional inputs to the draft were received during the meeting from the Expert Consultation participants.

The Annex "Process-oriented methodologies and information management tools for use in EAF implementation" was prepared by Patrick McConney (University of the West Indies) with Merle Sowman (University of Cape Town), Cassandra De Young (FAO) and Anthony Charles (St. Mary's University), based on the original Expert Consultation background document and other references. John M. Ward (National Oceanic and Atmospheric Administration – NOAA) provided the graphic "Interdependent influences of EAF management" during the Expert Consultation.

Abstract

This document aims to provide a better understanding of the role of the economic, institutional and sociocultural components within the ecosystem approach to fisheries (EAF) process and to examine some potential methods and approaches that may facilitate the adoption of EAF management. It explores both the human context for the ecosystem approach to fisheries and the human dimensions involved in implementing the EAF. For the former, the report provides background material essential to understand prior to embarking on EAF initiatives, including an understanding of key concepts and issues, of the valuation of aquatic ecosystems socially, culturally and economically, and of the many policy, legal, institutional, social and economic considerations relevant to the EAF. With respect to facilitating EAF implementation, the report deals with a series of specific aspects: (1) determining the boundaries, scale and scope of the EAF; (2) assessing the various benefits and costs involved, seen from social, economic, ecological and management perspectives; (3) utilizing appropriate decision-making tools in EAF; (4) creating and/or adopting internal incentives and institutional arrangements to promote, facilitate and fund the adoption of EAF management; and (5) finding suitable external (non-fisheries) approaches for financing EAF implementation.

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Contents

Preface

The original version of this document was prepared as a background document for use by participants in the FAO Expert Consultation on the Social, Economic and Institutional Considerations of Applying the Ecosystem Approach to Fisheries (EAF) held in Rome from 6 to 9 June 2006. That first document was also used as the primary background material and source of concepts and references for the supplemental EAF guidelines (FAO Technical Guidelines for Responsible Fisheries No. 4 Supplement 3 – The human dimensions of the ecosystem approach to fisheries[1]) discussed at the meeting. The objective of this document, as with the Expert Consultation itself, is to provide a better understanding of the role of the economic, institutional, and sociocultural components within the EAF process, and to examine some potential methods and approaches that may facilitate the adoption of EAF management.

These goals, in turn, reflect the state of the world in terms of EAF implementation, as described in the Prospectus for the Expert Consultation:

> *The concept of an ecosystem approach to fisheries (EAF) is reaching a point of general acceptance by those involved in fisheries and their management. There is general agreement that fisheries management must incorporate the complicated and often not-well-understood links between human activities and the environment. However, although the EAF approach is now commonly discussed in international colloquia, and excellent guidelines have been produced, most discussion has revolved around biological and environmental components (or biotic and abiotic compartments) of EAF. As a primary goal of an ecosystem approach is "to balance diverse societal objectives", social, economic and institutional information form an essential component of the information necessary for policy making. Such information is essential in order to evaluate the various benefits and costs related to any management decisions. Such benefits and costs include positive and negative externalities of ecosystem-based management as well as the benefits and costs directly incurred by individuals.*

In considering the interaction of social, economic and institutional factors with the EAF, four major "entry points" might be envisioned:

1. social, economic and institutional factors are often driving forces behind the need for EAF management;
2. the potential costs and benefits to individuals and society of applying the EAF will have social, economic and management components, as well as ecological ones;
3. social, economic and institutional instruments are all useful in the application of EAF, and in particular are relevant in creating incentives for EAF adoption; and
4. social, economic and institutional factors can all play roles in supporting or constraining the implementation of EAF management.

In other words, social, economic and institutional elements can be simultaneously drivers, constraints and/or supports for EAF implementation and, in addition, there can be social, economic and institutional outcomes of that implementation. All of these "entry points" need to be taken into account in EAF discussions.

This document therefore attempts to compile a selection of available fishery-specific, as well as non-fishery specific, literature (and methods) relating to how economic, social and institutional aspects: (1) drive EAF; (2) are valued and distributed among direct and non-direct users; (3) can be used as instruments in the application of EAF; and (4) are related to existing institutions. The document also explores possible means of financing the EAF, given that the costs and benefits related to EAF management have both private- and public-good aspects at local, regional, and global levels.

The document is divided into two main parts. The first part provides introductory and background material essential to understand prior to embarking on EAF initiatives.

[1] In preparation.

This material includes: (1) concepts, issues and considerations relevant to the EAF; (2) discussion of how aquatic ecosystems are valued, socially, culturally and economically, as well as the various non-market and market valuation techniques for assessing that value; (3) policy, legal, institutional; and (4) social and economic aspects relevant to the EAF, and. The second part covers the key issues facilitating the implementing the EAF: (1) defining the boundaries, scale, and scope of the EAF at hand; (2) the various benefits and costs involved in EAF, from social, economic, ecological and management perspectives, and the decision-making tools that can assist EAF implementation; (3) internal incentives and institutional arrangements that can be created and/or utilized for promoting, facilitating and funding the adoption of EAF management; and (4) external (non-fisheries) approaches for financing EAF implementation. The material presented in the two main parts of the report is complemented by an annex that reviews methods commonly used to meet two specific operational needs in EAF implementation – smoothly-running policy and planning processes and effective information acquisition and utilization.

It should be noted that this report is designed to cover a wide range of topics accessible to those in all fishery areas and disciplines, rather than to reflect the detailed state-of-the-art research on any one topic. Despite its breadth, however, there are certainly relevant topics not covered here. For a comprehensive treatment of the subject, the reader is encouraged to read this report in conjunction with the above-mentioned Guidelines as well as the *FAO Technical Guidelines for Responsible Fisheries* No. 4 – Fisheries management (1997 – hereafter, the FM Guidelines) and No. 4 Supplement 2 – The ecosystem approach to fisheries (2003 – hereafter, the EAF Guidelines) and the *FAO Fisheries Technical Paper* No. 443 – The ecosystem approach to fisheries: issues, terminology, principles, institutional, foundations, implementation and outlook (FAO, 2003a).

PART I

THE HUMAN CONTEXT FOR AN ECOSYSTEM APPROACH TO FISHERIES

1. Introduction and background

INTRODUCTION

In 2000, the United Nations Convention on Biological Diversity[1] (CBD) defined the ecosystem approach[2] (EA) as "a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way" and chose the EA as the primary framework for the CBD implementation; stressing a multidisciplinary collaboration to achieve the CBD objectives.[3]

In the fishery sector, the ecosystem approach has been similarly accepted as one of the key "vehicles" for developing and improving fisheries management. There have been, however, a multitude of variations on the definition of an EA; some have focused more on the natural science ecosystem components, while others stressed a more holistic and integrated (interdisciplinary) interpretation. In response to an international call for assistance to clarify what is meant by an EA in the fisheries context, the FAO published guidelines on the ecosystem approach to fisheries[4] in 2003.

Recognizing the wide range of interpretations of the approach, the FAO proposed the following definition, which is aligned with the more general EA but seeks a pragmatic balance by focusing the EAF on aspects within the ability of fisheries management bodies to implement, even while recognizing the fisheries sector's responsibility in collaborating in a broader multisectoral application of the EA:

> *an ecosystem approach to fisheries (EAF) strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries*

It is important to note that the concepts and principles of an EAF are not new – they are already either explicitly contained in a number of international and national instruments and agreements (e.g. as in the case of the CBD above) or implicitly manifested through local, regional, and international actions[5] – whether or not these explicitly used the term "EAF".[6]

In particular, other sector-specific applications of the EA include those to urban management, to drylands, to forestry, and to human health. Each of these is naturally interpreted from the perspective of the particular sector – albeit generally incorporating the trio of ecological, social and economic considerations. For example, the ecosystem approach to human health incorporates "human health considerations into the dynamic interrelations of ecosystem analyses" and "places humans in the centre of a series of

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1 http://www.cbd.int and CBC (2000). Report of the fifth meeting of the Conference of the Parties to the Convention on Biological Diversity. UNEP/CBD/COP/5/23.

2 For an historical description of the EA, see FAO (2003b).

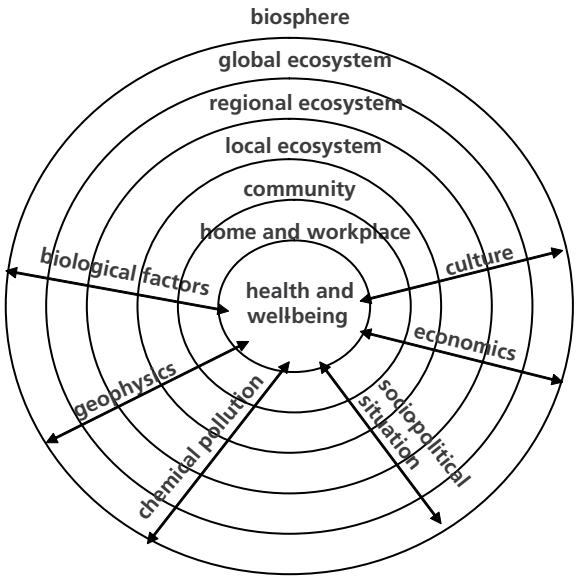
3 Which are "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding."

4 FAO (2003); hereafter referred to as the EAF Guidelines.

5 For brief presentations on national and international efforts at implementing the EAF, see the report from the Seventh meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea (12-16 June 2006) available at http://www.un.org/depts/los/consultative_process/consultative_process.htm.

6 Similar or related concepts include the ecosystem-based fisheries management (EBFM), environmental management, ecosystem management, sustainable management and biodiversity management.

FIGURE 1
Framework for an ecosystem approach to human health



nested spheres, which can negatively and positively influence health and well being" as shown below.[7]

From the above discussion of EA and EAF concepts, the next step lies in understanding what the approach means in practice. This report is grounded in the belief that the **application** of the EAF must be holistic, integrated, participatory, and adaptive, and builds on the EAF Guidelines by providing here a focus on the human dimensions (i.e. political, legal, cultural, social, economic and institutional aspects) of such an application.

Specifically, this report acknowledges the following "entry points" of human considerations – social, economic and institutional – into the implementation of an EAF:

1. Social, economic and institutional objectives and factors may be **driving forces** behind the need for EAF management;
2. The **costs and benefits** of applying the EAF, whether to individuals or to society, have social, economic and institutional impacts and implications;
3. Social, economic and institutional **instruments** are all crucial for successful implementation of the EAF; and
4. Social, economic and institutional factors present in fishery systems can play either **supporting or constraining roles** in EAF implementation.

In other words, social, economic and institutional elements can be simultaneously drivers, constraints, and/or supports for EAF implementation, and in addition, there can be social, economic and institutional outcomes of that implementation. All of these "entry points" need to be taken into account in EAF discussions.

Basically, the EAF takes place in the context of societal and/or community objectives, which inherently reflect human aspirations and values. As implementation of the EAF is a human pursuit, the social and economic forces at play need to be understood, the incentives and disincentives driving human behaviour need to be investigated, and actions need to be undertaken in terms of fishery governance and corresponding institutional arrangements – all so that management can induce outcomes in the fishery compatible with societal objectives.

In addition, although focusing on the fisheries sector, EAF will have inter and intra-sectoral process components that must be taken into account, even if beyond the scope of the fisheries managers' direct responsibility. However, the more integrated or cross-sectoral the approach taken is, the more likely the attainment of sustainable development goals.

Certainly, the need to incorporate human components of the fishery system into an ecosystem approach is clear as humans are part of, depend on, and affect the ecosystem in which they live, work, and play. The challenge lies in implementation. This report seeks to provide support in meeting that challenge, by consolidating a range of available knowledge and experience relevant to EAF implementation, from social, economic and

[7] The Ecosystem Approach to Human Health and Neurotoxics Working Group – http://www.unites.uqam.ca/neuro/.

institutional viewpoints, and examining the manner by which these aspects can be practically incorporated, as well as highlighting the remaining gaps in both knowledge and implementation.

UNDERSTANDING THE COMPLEXITIES AND CONTEXTS

In any given fishery in which implementation of EAF management is being planned, it is important to understand the current state of the fishery and its natural and human environment (the starting point) – the context in which EAF is being developed. This must be the first step in interpreting the EAF for the given situation.

For example, knowing the context will help clarify if the particular EAF will be: incremental or wholesale, intersector or intra-sectoral, local or international, involving intensive scientific research or relying on the best available information, etc. Establishing this EAF context will involve not only understanding the fishery/ecosystem from both the natural science and human perspectives, but also society's goals and values with respect to ecosystem goods and services; the socio-economic context (at the micro and macro levels) in which the fishery operates; the policy and institutional frameworks in place; as well as the political realities and power dynamics affecting the governance of resources. A good understanding of these issues and other realities surrounding the use of aquatic resources is essential to guide EAF policies, objectives and plans – in their absence, policies and plans may very likely fail to assist in the move towards sustainable fisheries.

The human aspects that play a role in determining an EAF include the power and governance structures in place, the economic "push" and "pull" mechanisms driving the fishing activities, the socio-cultural values and norms associated with fishing, and the external contexts (e.g. global markets, natural phenomena, emergencies, and political changes) that impact on our ability to manage our fisheries. Chapters 2 through 4 describe many of the human dimensions and the techniques available assisting their evaluation, surrounding the EAF context.

The context also includes the *motivation* for the EAF. The list of potential factors driving fisheries managers, a community, or a society to adopt the EAF is as extensive and varied as the list of potential reactions to these drivers. These drivers may include human as well as biological factors, at any scale (from local to international), and may be reactionary or forward looking. For example, countries may be reacting to international treaties or conventions, to crises and conflicts within and around the fisheries, or to lobbying from special interest groups. Alternatively, countries may be adopting the EAF as part of a future framework for achieving sustainable development.

KEY CONCEPTS AND ISSUES

This part of the report discusses (i) the idea of an EAF management, highlighting the role of human aspects, (ii) key underlying issues in implementing the EAF (i.e., boundaries, scale and scope), and (iii) the relationship of the EAF to complementary approaches that also include broader looks at the components and interactions in the fishery (the livelihoods approach and integrated management).

EAF management

The word "management" has been purposely left out of the term "EAF" as the approach is not limited to management but applies to policy, legal frameworks, development, planning, etc. However, some of the early motivation for the EAF lay in the recognition that single-species stock assessment and management (what is referred to in the EAF Guidelines as "Target Resource Oriented Management" or TROM) could be insufficient and that there was a need to look more broadly at the surrounding ecosystem – prey and predator species, oceanographic effects, environmental impacts of other human activities, etc.

This broadening of attention from individual species to multiple fish species and ecosystems includes the management of a range of human interactions with the fishery ecosystem, whether technical, economic, social or institutional. Furthermore, the EAF must deal to some extent with interactions with other uses of the aquatic environment, and with linkages throughout the fishery system (e.g. to the post-harvest sector and the socioeconomic environment of the fishery).

Overall, then, the EAF must incorporate whatever ecosystem and human considerations are of direct relevance to fisheries management, i.e. which will typically need to be taken into account for effective fisheries management. This is not really any different from the situation in conventional fishery management, which also needs to take human considerations into account to be successful (even if this has not always been achieved – see, e.g. Charles, 1998a; Cochrane, 2000). However, as pointed out in the EAF Guidelines, the challenge is that much greater in EAF, given the consequent broadening of attention that is needed, to include aspects of ecosystems and of corresponding human elements.

There has been some progress in meeting this challenge, both in terms of moving towards an improved understanding of social, economic and institutional aspects relating to fishery management (and EAF in particular), and in terms of developing tools and instruments to improve management by taking this understanding into account. On the other hand, even with conventional management and certainly with EAF, there remains a gap between words and deeds when it comes to incorporating such aspects into fishery management. One indication of this gap is the recurring pleas from social scientists, over the past several decades, for increased progress in this direction.

The efforts of countries to address aspects of EAF have arisen in three main categories:

1. Issue-based technically-oriented actions, such as:
   - reducing the impacts on bycatch species;
   - increasing the selectivity and decreasing the harmful impacts of fishing gear;
   - protecting and restoring critical habitats and species interactions;
2. Implementation of institutional changes as part of national EAF measures, such as:
   - changing fisheries policies to include EAF and precautionary principles;
   - increasing stakeholder involvement in fisheries management;
   - creating multidisciplinary and/or intersectoral advisory groups/committees;
   - taking part in multicountry projects aiming at harmonizing management at the large marine ecosystem level;
   - using community-based management tools; and
3. Broadening the nation's information systems to include:
   - multispecies or ecosystem models (looking at changes across the food web);
   - bio-economic models (looking at changes across the fish and the fishing industry);
   - incorporated qualitative and quantitative models, such as people's perceptions;
   - multidisciplinary information in risk assessments and cost-benefit analyses;
   - local and/or traditional knowledge;
   - integrated indicator systems;
   - participatory information systems.

While there seem to be few examples to date of a comprehensive adoption of the EAF in all aspects of the fishery system (i.e. from the policy realm to implementing adaptive management operationally, and also adjusting institutional and other supporting frameworks), there have been many incremental moves, and the momentum is building towards broader use of the EAF in many fisheries.

Social, economic and institutional considerations in EAF

A wide range of social, economic and institutional considerations may be relevant to the implementation of an EAF:

1. First, EAF must take place in the context of societal and/or community objectives, which inherently reflect human aspirations and values.
2. Second, as EAF takes into account interactions between fisheries and ecosystems, this includes a wide range of complexities relating to human behaviour, human decision making, human use of resources, and so on.
3. Third, *implementing* the EAF is a human pursuit, with implications in terms of the institutional arrangements that are needed, the social and economic forces at play, and the carrots (incentives) and sticks (e.g. penalties) that can induce actions compatible with societal objectives.

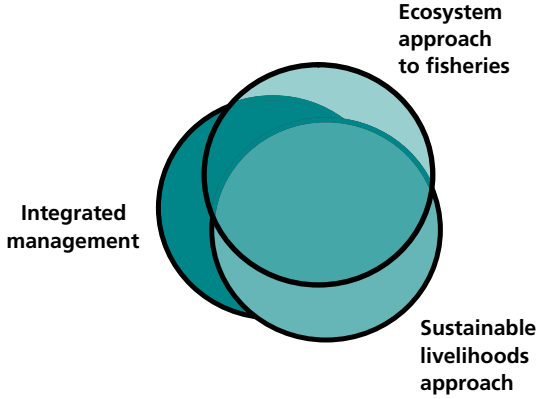
Indeed, the latter aspect – that of institutional arrangements – highlights the need in EAF for structured decision making processes, grounded in the accepted set of societal objectives, and governed by a suitable set of operating principles – what has been referred to as a "fishery management science" approach (Lane and Stephenson, 1995). The fishery objectives being pursued underlie the criteria for judging success, which are in turn needed in order to decide on the best management approach. Parallel to the objectives are principles governing fishery management, which influence the choices made of policy and management measures to best meet the stated objectives – these are drawn from a range of sources such as national legislation, international conventions, and "approaches" including the precautionary approach and the ecosystem approach.

Such processes must take place in a world of complexity, and the hope is that EAF provides an effective vehicle to better recognize and address the wide range of complexities in fisheries, complexities that can bear directly on the success of fisheries management. Social, economic and institutional aspects contribute as much to the set of complexities faced within fishery management as do those relating to fish species and the aquatic environment itself. For example, a fishery typically faces the complexities of: (a) multiple and conflicting objectives; (b) multiple groups of fishers and fishing fleets and conflicts among them; (c) multiple post-harvest stages; (d) complex social structures, and socio-cultural influences on the fishery; (e) institutional structures, and interactions between fishers and regulators; and (f) interactions with the socioeconomic environment and the larger economy (Charles, 2001).

EAF, the livelihoods approach and integrated management

The move towards a broader approach to fisheries management reflects the fundamental goal of sustainable development, in keeping with WSSD objectives. To this end, it is useful to look at the ecosystem approach to fisheries in comparison with two major multisectoral thrusts in global discussions relating to natural resource and spatial area management: the livelihoods approach and the integrated management approach. These complementary and overlapping approaches, and interactions with the EAF (Figure 2), are discussed in this section.

FIGURE 2
Relationships among the EAF, the LA and IM



The livelihoods approach

Just as the ecosystem approach has developed from an understanding of the need to manage target fish stocks and fishing in the broader context of the ecosystem, similarly the livelihoods approach (Ellis,

2000; Allison and Ellis, 2001) grew from a recognition of the need to place fisheries in a larger context of households, communities and socio-economic environments. Adopting a livelihoods thinking into EAF implies that fisheries management must look at fishers and fishing fleets in the context of where fishers live, in households, communities and fishery-based economies – just as it deals with the fish in the context of where the fish live, the ecosystem. Fisheries management thus deals with the fishery as one of a portfolio of livelihood sources (if such alternatives exist) and as potentially linked, through livelihoods, to other economic sectors.

A livelihoods approach can inform fisheries management in a number of ways, which may, if desired, be incorporated as well into EAF management:

- demographic: population and population trends, migration, age and gender structure;
- sociocultural: community objectives, gender roles, stratification, social cohesion;
- economic: income and its distribution, degree of fishery dependence, markets;
- institutional: community organization and infrastructure, involvement of women;
- marine Infrastructure: wharves, markets;
- community infrastructure: cultural facilities, schools, religious institutions;
- non-fishing activities: boatbuilding, agriculture, tourism, industry; and
- policy: linking fishery objectives to broader regional and national policy goals.

Integrated management

Integrated management (whether of oceans, coasts, watersheds, etc.) is an approach, or mechanism, to manage multiple (competing) uses of a certain designated area – uses such as fisheries, aquaculture, forestry, oil and gas, mining, agriculture, shipping and tourism. This involves managing multiple stakeholders[8] (e.g. local communities, industries) as well as interactions among people and ecosystems, and among multiple levels of government. The integrated management approach is typically characterized by attention paid to a multiplicity of resources (e.g. soil, water, fish stocks, etc.) and of habitats (e.g. open ocean, estuaries, wetlands, beaches, lakes, rivers, etc.), as well as a range of environmental factors (e.g. changes in water temperature, turbidity and acidity, chemical pollutants and water flows).

Typically, integrated management – like the EAF and the sustainable livelihoods approach – involves processes for participatory decision making and conflict resolution, and requires a range of information on characteristics of the designated area, from the local climate and the state of the ecosystem, to the relevant natural resources, and the human community (cultural, economic, social).

A key aspect of integrated management is the implementation of an institutional framework in which to manage the mix of components and interactions within the relevant system, incorporating these aspects within a wider context of human-environment interactions, institutional linkages, multiuse conflict, multistakeholder governance systems and the like. This aspect of integrated management, involving institutional frameworks and managing multiple uses, is similar to that of EAF, but operating in a multisectoral context (i.e. fisheries together with other marine, coastal and/or watershed uses, such as shipping, mining, etc.), rather than solely within the fishery sector. Thus, EAF and integrated management are very much complementary, needing to operate in synchrony even while their scope differs with respect to what is being managed.

[8] The concept of stakeholders comprises all interested parties, whether they are classified as primary, secondary or tertiary stakeholders.

CONCLUSIONS

Adoption of EAF management will, on the one hand, ensure that we take into account impacts of the broader fishery system (the ecosystem and relevant human elements) on fishery management, and at the same time, ensure that the broader consequences of management actions are assessed. The boundaries, the scale of management, and the scope of that management are all crucial factors to consider in implementing EAF management in practice. The EAF deals with the "bigger picture" around fisheries, specifically to allow us to encompass relevant factors affecting and interacting with management from across the fishery system and beyond. EAF management: (1) looks at managing target fish species and fishing activity within the context of the ecosystem; (2) looks at the fishery within a larger context of households, communities and the socioeconomic environment (with support from the livelihoods approach); and (3) considers fishery management in a broader institutional context of managing multiple resource uses (feeding into and interacting with integrated management approaches).

2. Human values of ecosystem services

INTRODUCTION

That ecosystems provide services[9] to human beings (e.g. food, recreation, water, aesthetics) is indisputable. The question of whether and how to formalize the values of these services to society remains a difficult and, at times, controversial subject. This chapter will present briefly: 1) an overview of potential services provided by ecosystems; 2) an overview of the various classifications, from the point of view of economists, of the values that humans may attribute to these services; 3) the methodologies in use to estimate these values, qualitatively or otherwise; and 4) how this information can help in implementing the EAF.

ECOSYSTEM SERVICES

Ecosystem services are a sub-set of the intricate workings of ecosystems in that they are those benefits, both tangible and intangible, provided by ecosystems for which there is an explicit demand by humans (MEA, 2005a)[10]. Trying to make sense of and organize conceptually the myriad of such services provided would be a complicated task for any natural resource manager. Fortunately, in undertaking a global review of ecosystems and their services, the Millennium Assessment (MEA, 2005a) has reviewed various classifications of ecosystem services and suggested a set of four, sometimes overlapping, categories:

- **Provisioning** – the products obtained from ecosystems, including food and fibre, fuel, genetic resources, bio-chemicals, natural medicines, pharmaceuticals, ornamental resources, and fresh water;
- **Regulating** – the regulation of ecosystem processes including those relating to air quality, water, climate, human diseases, erosion, biological controls, and storm protection;
- **Cultural** – the nonmaterial benefits people obtain from ecosystems through, for example: spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences, including cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, and recreation and ecotourism; and
- **Supporting** – the benefits "that are necessary for the production of all other ecosystem services. They differ from provisioning, regulating, and cultural services in that their impacts on people are either indirect or occur over a very long time."

Fishery-related ecosystem services would be a further sub-set relating to the ecosystem services of importance to fisheries. The definition of this sub-set would be context specific and could range, depending on the scope of the EAF, from being very

[9] The term "services" includes tangible goods (food, water, etc.) as well as intangible services (cultural, ecological, etc.).

[10] Boyd *et al.* (2004) note that "it is the services created by ecological characteristics that will be explicitly tied to social value" and make the distinction that "ecosystem services are the outcomes of ecosystem functions that yield value to people."

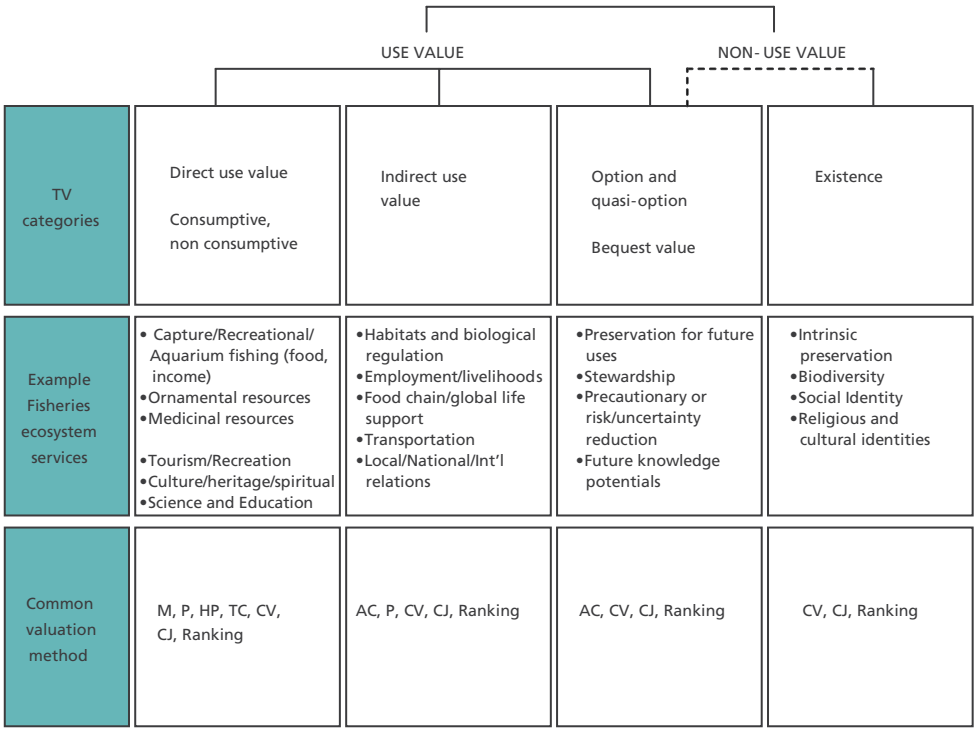
narrow, only including aspects of the target and related species, to a broader inclusion of the entire gamut of ecosystem services, however linked to the fisheries at hand. Ideally, one should move as far towards the latter definition as possible, to incorporate as integrated an EAF implementation as possible. When making decisions about certain fisheries, fisheries managers and other stakeholders would need to know the impacts of their decisions (or lack of decisions) on other sectors and/or benefit holders, in terms of the stream of services provided. Activities meriting management could include, for example, (1) upstream agriculture runoffs impacting the fishery ecosystem's ability to regulate water quality and hence support abundant populations of the targeted species, or (2) destructive fishing practices, such as dynamite fishing harming coral systems, which negatively impact the tourism sector or other members of the community who benefit from the coastal region.

Every time a decision is made, whether it be to start, stop, or change an activity, the decision will impact the stream of services provided by the natural system and, either directly or indirectly, human welfare. Behind any decision, there may be winners and there may be losers in terms of welfare and there will certainly be tradeoffs. Decision-makers in fisheries need to understand what services the aquatic ecosystems provide, to whom (e.g. the fisheries, the communities and economies dependent on them, and others who hold value for these services), and how the distribution of these services will change once the decision is implemented.

THE VALUE OF ECOSYSTEM SERVICES TO HUMAN WELL-BEING

Just as it is useful to categorize ecosystem services to aid in understanding what they are, so too is it useful to categorize the types of values individuals and societies hold for these services. An attempt at such a categorization is presented in Figure 3, providing

FIGURE 3
Total value of a fisheries ecosystem



Sources: adapted from MEA, 2005b; Farber *et al*., 2006
Notes: M = market methods, P = Production approaches, HP = Hedonic Pricing, TC = Travel Cost, CV = Contingent Valuation, CJ = Conjoint analysis, AC = Avoidance Cost

a schematic framework for the various categories of values that humans may hold for ecosystem services.

The framework is divided into use values and non-use values for a particular ecosystem's services. Use values occur when individuals and societies derive benefits and, hence, have value for ecosystems services they use or interact with directly, such as for food, for recreational activities and relaxation, and for other tangible products that come from these ecosystems (direct use). Non-use values, on the other hand, reflect situations in which we value the services indirectly for their supporting and regulating functions, such as maintaining water quality and community traditions (indirect use).

Individuals and societies also value ecosystems for what they represent for the future. Some may value today the knowledge that their grandchildren will benefit from these services and others value having resources available in the case they become necessary for their direct use in the future (referred to as "option value"). In addition, some value the services independently of anyone's current or future uses of these services ("existence values"). This category represents a philosophical value of the inherent right of ecosystems and communities to exist now and in the future. This perhaps vague but very important value can reflect the idea that each part of the ecosystem exists for a reason, whether we are aware of the reason or not, and therefore should be valued as part of the ecosystem.

The above framework may assist in determining the list of ecosystem services potentially affected by management actions. In this regard, two points should be noted. First, it is important to differentiate between the values of a given individual, and those collective values of a community, or of society as a whole. Second, one can expect debates to occur over the balancing of the various values described here – use, non-use, existence and option values. Overall, the key act of bringing together the multisectoral, multidisciplinary stakeholders involved, to identify the various values linked to an ecosystem and to consider which are likely to be affected by management decisions (and how) is one step in understanding the interactions of the fishery and its ecosystem.

The next step in the management process stems from limitations imposed by two realities: 1) that financial and human resources are not unlimited, and 2) that often we cannot improve everything all the time (i.e. there will be tradeoffs attached to each decision). Because of such constraints, decision-makers need some way of prioritizing the changes to the various ecosystem services.

There exist techniques to identify the EAF "issues" and risks in specific fisheries and to determine preliminary priorities for those issues, such as check lists and problem/component trees combined with risk assessments[11,12]. Component trees assist in organizing the scoping and understanding of the services provided by ecosystems. For example, a top level of the tree may branch out into three categories: ecological well-being, economic well-being, and ability to achieve; followed by successive branches organizing ecosystem services further, such as in Figures 4a and 4b. Stakeholders would use these trees to organize their thoughts regarding the ecosystem in question.

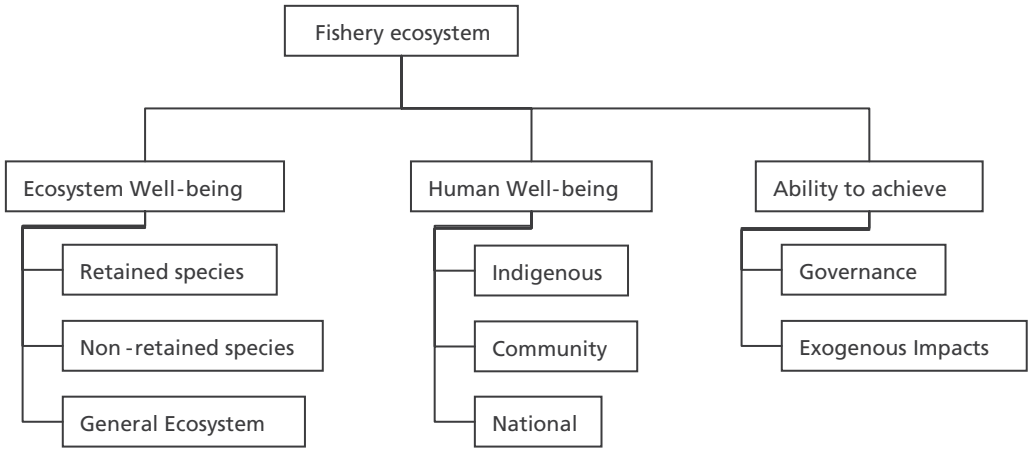
Once the (probably) large number of services has been identified, some sort of prioritization would need to take place before investing in additional analyses. Fletcher *et al.* (2002) propose analysing the magnitudes and probabilities of change in services from implementing a management decision (or not) through risk assessment techniques. This risk assessment would help pull out the relatively highly important services that would require immediate additional consideration.

[11] For example, see the methods used in the ecologically sustainable development (ESD) process for fisheries in Australia; http://www.fisheries-esd.com.

[12] The EAF Guidelines promote this approach and it has been used by FAO in a number of case studies, including the Benguela Current Large Marine Ecosystem programme. In addition, the FAO is developing more globally applicable problem trees based on the Australian ESD trees.

FIGURE 4A

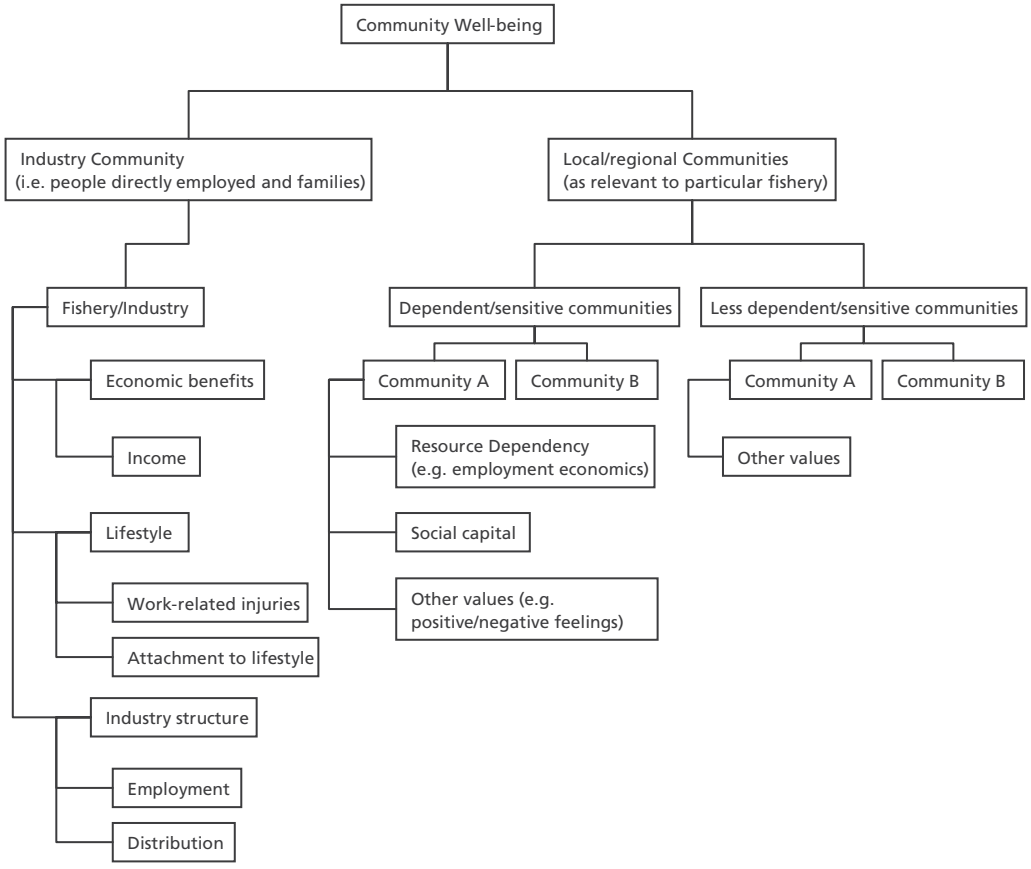
Top level component tree for understanding the contributions of a fishery ecosystem to well-being



Source: Adopted from Fletcher *et al*., 2002

FIGURE 4B

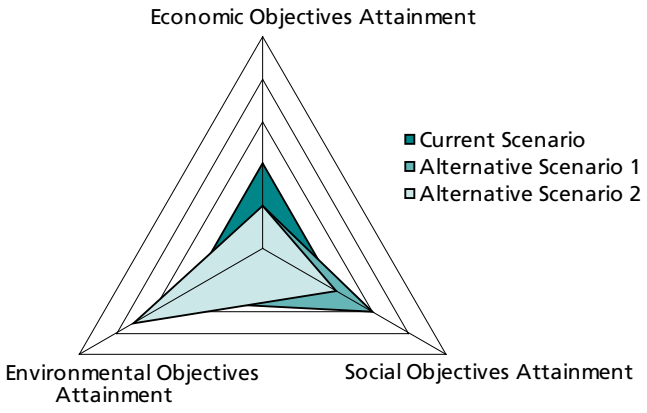
Lower level component tree for understanding the contributions of a fishery-related ecosystem to socio-economic well-being



Source: Fletcher *et al*., 2003

The following section describes some of the methods (quantitative and qualitative) available for further analysis in order to assist decision-makers when contemplating management actions.

FIGURE 5
Example tradeoff representations of alternative management scenarios



METHODOLOGIES FOR ASSESSING THE VALUE OF FISHERIES ECOSYSTEMS

As it is impossible to maximize all societal objectives concurrently, tools are necessary to describe the social, economic, and environmental tradeoffs involved with each management alternative. For example, in Figure 5, three management alternatives are presented in terms of their attainment of environmental, social and economic goals. Each alternative has its own mix of impacts. In order to make comparisons among the possible alternatives, it is useful to have a standardized basis for comparison between two or more states of goods and services provided by an ecosystem. This section presents a few methods commonly used in economics to provide standardized information for decision making.

Given that the cost-benefit framework[13] is currently the most common method for comparing alternatives in decision making, the issue of standardizing the values of services becomes imperative, as important values may be ignored if they are not placed into the cost-benefit language. The rational for this economic valuation[14] approach includes the assumptions that 1) in the absence of such valuations, potential changes in ecosystem services may be otherwise attributed either a zero or an infinite value in a cost-benefit analysis decision-making process; 2) such an approach provides a common unit of measurement (either monetary or ranking) for understanding the contribution of fisheries ecosystems to human well-being and understanding the potential tradeoffs among these contributions linked to management choices; and, 3) human beings make decisions in line with the incentives they face, so understanding such incentives would enable decision makers to understand current fishery ecosystem use choices and potential changes in these choices if such incentive structures evolve.[15]

Figure 3 above, matched the use and non-use categories of ecosystem services with a few of the common methods used to evaluate these services. These methods may be grouped into (1) those that estimate a monetary value for a service and (2) those that do not attempt to place a nominal value but try to provide relative values. The former group estimates how much people are willing to pay for a service or a change in a service and include market-based as well as non-market-based methods. Market-based values are relatively easier to estimate, as quantitative values exist already in one form or another, although they may require some filtering in order to isolate the value of the service at hand. For example, the value of a healthy bay may be nested within the real estate values surrounding the bay. Additionally, the value of a fishery may be theoretically reflected in the value of the use rights to the fishery.

[13] See Chapter 6 for further details on cost and benefits related to the EAF as well as cost-benefit analyses.

[14] Economic valuation differs from other disciplines' values (e.g. ecological value) in that it is focused on human preferences and is measured in terms of how much individuals are willing to forego in other goods and services to obtain a given good or service (Lipton *et al.*, 1995).

[15] See Chapter 7 for a discussion on the use of incentives for obtaining management objectives.

BOX 1

Sample methodologies for assessing value of fisheries ecosystems to human well-being

Conventional economic valuation

Revealed-preference approaches

Travel cost: Valuation of site-based amenities are implied by the costs people incur to enjoy them (e.g. improved sports fishing activities, whale watching);

Market methods: Valuations are directly obtained from what people must be willing to pay for the service or good (e.g. ecolabelling price differentials, increased value of a fishery);

Hedonic methods: The value of a service is implied by what people will be willing to pay for the service through purchases in related markets, such as housing markets (e.g. vessel purchases, housing purchases on coastal areas and waterfronts); and

Production approaches: Service values are assigned from the impacts of those services on economic outputs (e.g. increased efficiency from bycatch reduction methods, improved CPUE in a fishery).

Stated-preference approaches

Contingent valuation: People are directly asked their willingness to pay or accept compensation for some change in ecological service (e.g. coastal reef preservation, endangered species protection); and

Conjoint analysis: People are asked to choose or rank different service scenarios or ecological conditions that differ in the mix of the conditions (e.g. marine protected areas with varying levels of permitted human activities).

Cost-based approaches

Replacement cost: The loss of a natural system service is evaluated in terms of what it would cost to replace that service (e.g. alternative coastal livelihoods); and

Avoidance cost: A service is valued on the basis of costs avoided, or the extent to which it allows the avoidance of costly averting behaviours, including mitigation (e.g. participatory fisheries management reduces conflicts, health benefits of fish products).

Non-monetizing valuation or assessment

Individual index-based methods, including rating or ranking choice models, expert opinion (e.g. expert review of sea turtle stocks, their conservation, status, and major threats).

Group-based methods, including voting mechanisms, focus groups, citizen juries, stakeholder analysis (e.g. fisheries management advisory councils, GIWA LME assessments).

Notes: Examples have been changed to reflect fisheries aspects. For a concise review of these methods including limitations, see Pagiola *et al*. (2004).

Source: Farber *et al.* (2006).

Non-market-based methods are necessary when the ecosystem service in question is not traded in a market. Examples of such services include the cultural identity of coastal communities, the preservation of ecosystems for their intrinsic value, or changes in water quality. Although without established prices, these services may be highly valued. Non-market based methods tend to focus on creating fictional markets for the service in question in that people are asked to contemplate how much of market

goods, which have established prices, they would be willing to forego in exchange for the service. For example, an individual can conceptualize foregoing a meal in order to support the conservation of a marine mammal. If on average, this person spends $30 on a meal, they would be willing to pay $30 for the conservation activity.

Non-monetary methods focus on the relative values of services in that they provide information regarding one ecosystem service relative to another ecosystem service (e.g. it would be more detrimental to well-being to lose service A than service B).

The box below lists some of the methodologies in use for assessing values of fisheries ecosystems to human well-being. Each approach is replete with its own set of limitations, criticisms, and cost implications, and the application of each will depend on the specific issue at hand. Appendix 2.1 provides examples of fisheries-related case studies in which these methodologies have been applied. These examples have been chosen to represent the wide-range of methodologies and their application to multiple fisheries-related issues; however, they do not fully represent the limitations and assumptions associated with each methodology.

HOW ECOSYSTEM VALUATION CAN HELP IN IMPLEMENTING THE EAF

Such valuation methods would provide nominal or relative value estimates, which would then be incorporated into a broader evaluation or into decision-making mechanisms, such as cost-benefit analyses, indicator frameworks, national accounting systems, asset mapping, and bio-economic models. As mentioned previously, such mechanisms would allow the decision-makers to better understand the social, environmental, and economic tradeoffs related to any management alternatives. The use of such broader evaluation mechanisms in EAF management will be discussed in Chapter 6. A complete review of conceptual and practical issues regarding cost-benefit analyses with special regard to the environment may be found in Pearce *et al.* (2006).

There are various caveats to emphasize. First, the valuation of many ecosystem services, especially non-market benefits, is complicated and often costly and will not resolve all decision-making questions. Many, indeed, are ethically opposed to the idea of placing a value on the ecosystem or on cultural values. Furthermore, other ethical issues, such as balancing existence and bequest values against use values, or treating the winners and losers of management measures equally, may remain at the discretion of decision-makers. Second, many of these methods are based on individual preferences and values, which are then aggregated by the number of individuals "affected". This is not necessarily the same value as a societal value of a service.

CONCLUSIONS

The EAF calls for the inclusion of a wide range of ecosystem services in planning, management, and development. Many methods exist for assisting in deepening our knowledge of the value of ecosystem services to individuals, communities, and societies. These values may then be placed into the appropriate decision-making tools in order to understand the possible trade-offs and impacts of the management options under evaluation. Unfortunately, such information comes at a price; therefore, proper thought and planning are necessary before investing in the data collection and analysis process. Included within this planning is the explicit identification by fisheries managers of their objectives and needs with respect to data collection in the search for the most appropriate (and least cost) methods for obtaining these data.

APPENDIX 2.1
Examples of the use of valuation tools in fisheries

Case study – *Contingent valuation*: economic value of non-commercial fish

Situation – Rivers in the Four Corners Region (United States of America) provide 2 465 river miles of critical habitat for nine species of fish that are listed as threatened or endangered. Continued protection of these areas required habitat improvements, such as fish passageways, as well as bypass releases of water from dams to imitate natural water flows needed by fish. A contingent valuation survey was used to estimate the economic value for preserving the critical habitat.

Application – Survey respondents were provided detailed maps that highlighted the areas designated as critical habitat units for the fish. They were told that some State and Federal officials thought the combined costs of the habitat improvements and the restrictions on hydropower were too costly and had put forward a proposal to eliminate the critical habitat unit designation. They were asked if they would contribute to the Four Corners Region Threatened and Endangered Fish Trust Fund.

Respondents were also told that efforts to raise funds would involve contributions from all United States taxpayers. If a majority of households voted in favor of the fund, the fish species would be protected from extinction. This would be accomplished through water releases from Federal dams timed to benefit fish, and through the purchase of water rights to maintain instream flows. Also, within the next 15 years, three fish species would increase in population to the point that they would no longer be listed as threatened species.

On the other hand, if a majority of households in the United States voted not to approve the fund, the critical habitats shown on the map would be eliminated. This would mean that water diversion activity and maximum power production would reduce the amount of habitat for these nine fish species. Respondents were told that if this occurred, biologists expected that four of the nine fish species would likely become extinct in 15 years.

The exact wording on the questionnaire was: Suppose a proposal to establish a Four Corners Region Threatened and Endangered Fish Trust Fund was on the ballot in the next nationwide election. How would you vote on this proposal? Remember, by law, the funds could only be used to improve habitat for fish. If the Four Corners Region Threatened and Endangered Fish Trust Fund was the only issue on the next ballot and it would cost your household $_____ every year, would you vote in favor of it? (Please circle one.) YES / NO

The dollar amount, blank in the above illustration, was filled in with one of 14 amounts ranging from $1–$3 to $350, which were randomly assigned to survey respondents.

Results – The questionnaire was sent to a random sample of 800 households in the Four Corners states of Arizona, Colorado, New Mexico, and Utah (with the proportions based on the states' relative populations). An additional 800 households were sampled from the rest of the United States. The average willingness to pay was estimated to be $195 per household. When extrapolated to the general population, the value of preserving the habitat areas was determined to be far in excess of the costs.

Source: King and Mazotta, Undated.

Case study – *Conjoint analysis:* choice management of the Peconic Estuary System, New York

The situation – The environmental and natural resources of the Peconic Estuary System (United States of America)—the bay waters, beaches, wetlands, ecosystems, habitats, and parks and watershed lands—provide many services to the public. The Peconic Estuary Program was established under the National Estuary Program, to create a conservation and management plan for the environment and natural resources of the Estuary.

The challenge – In order to develop a management plan that best serves the public, information was needed about the value that the public holds for the ecosystem services of the Estuary.

The analysis – Several studies were conducted to estimate the uses and economic values associated with the Estuary, including a contingent choice survey to estimate the relative preferences and economic values that residents and second homeowners have for preserving and restoring key natural and environmental resources: open space, farmland, unpolluted shellfish grounds, eelgrass beds, and intertidal salt marsh.

The results – Early discussions revealed that the public has a strong attachment to environmental and amenity resources of the Peconic Estuary, even if they do not use these resources directly. Most respondents to the survey (97 percent) supported at least one hypothetical action to protect resources, and indicated they would financially support such actions. The relative priorities of respondents for protecting natural resources, in order, were for farmland, eelgrass, wetlands, shellfish, and undeveloped land. The estimated per acre dollar values were about $13 000 for undeveloped land, $30 000 for unpolluted shellfish grounds, $54 000 for saltmarsh, $66 000 for eelgrass and $70 000 for farmland. The survey results indicated that the resource priorities, or relative values of resources, are more reliable than are the dollar estimates of values, and thus the researchers recommended that relative values, rather than dollar values, be used in the process of selecting management actions.

Source: King and Mazotta, Undated.

Case study – *Production function*: mangrove-fishery valuation in southern Thailand

"The undervaluation of natural products and ecological services generated by mangrove ecosystems is a major driving force behind the conversion of this system into alternative uses." (Rönnbäck, 1999)

The situation – In recent decades, over 1975–1993 the area of mangroves has virtually halved, from 312 700 hectares (ha) to 168 683 ha. Although the rate of mangrove loss has slowed, in the early 1990s the annual loss was estimated to be around 3 000 ha/year for all of Thailand, and 1 200 ha/year in Surat Thani province. The Gulf of Thailand mangroves are thought to provide breeding grounds and nurseries in support of several species of demersal fish and shellfish, mainly crab and shrimp.

The analysis – To analyse the impact of mangrove deforestation on these fisheries in Surat Thani, harvesting in both demersal and shellfish fisheries was assumed to follow a Cobb–Douglas function of the level of fishing effort and mangrove area. A separate harvesting function was assumed to apply to demersal fish as opposed to shellfish. A panel analysis was conducted to estimate the effort function for all shellfish and all demersal fish in the Gulf of Thailand. The analysis combined harvesting, effort and mangrove data across all five zones of the Gulf of Thailand and over the 1983–93 time period. The cost functions derived for each fishery were used to estimate the likely welfare impacts of a change in mangrove area in Surat Thani, assuming alternatively open access and managed fishery conditions.

The results – For all mangrove-dependent fisheries, the value of a change in mangrove area ranged from US$33-110/ha, depending on whether the fisheries are open access or Managed and the demand elasticity. Given an annual loss of 1200 ha of mangroves in Surat Thani, which was approximately the annual rate of mangrove conversion recorded in the early 1990s in the province, the economic loss in terms of support of the Gulf of Thailand fisheries in Zone three was estimated to be around US$100 000 per year, if these fisheries were optimally managed. Under open access conditions, this economic loss ranges from US$40 000 to US$132 000, depending on demand elasticities.

These partial results should then be placed within a multiple-use, multiple-objective context in which the benefits and costs of alternative land-use choices may be evaluated and compared.

Note: For a discussion of the value for seafood production (aquaculture and capture-based) of mangroves, see Rönnbäck (1999).

Source: Barbier, 2000

Case study – Destruction and loss costs of coral reefs in the Philippines

- Healthy coral reefs can produce, on a sustainable basis, 20 tonnes or more of fish and other edible products per square kilometer per year; once destroyed by use of dynamite or cyanide for fishing, production is reduced to less than 4 tonnes/km²/yr. The sustainable catch from a good reef over ten years is about 200 tonnes while a destroyed but recovering reef catch over the same period is only 72 tonnes – the loss being 128 tonnes of fish with an estimated value of US$192 000 (US$19 200 yearly) at current (year 2000) market prices for reef fish.
- The net present value of benefits per km² from blast fishing to individuals over 25 years (assuming a ten percent discount rate each year) is only US$14 600. This small gain is compared to losses of: US$400 000 from loss of tourism potential, more than US$190 000 from loss of coastal protection and about US$108 000 from foregone sustainable fishery income, all dependent on a healthy coral reef.
- Bacuit Bay, Palawan was the subject of a study that determined that over a ten-year period reef fisheries and tourism would generate US$41 million more than logging the forests in the watershed affecting the bay. Logging in this case caused sedimentation that would have destroyed the coral reefs for both fisheries and tourism in the bay.

Source: compilation of studies by White *et al.*, 2000

Case study – *Travel cost* estimation: oyster reef restoration project in Chesapeake Bay

The situation – For nearly half a century, oyster harvests (and stocks) have been declining in both Maryland and Virginia (United States of America). Three factors have led to the decline of the oyster: over harvest, disease, and sedimentation. Because of the decline in oyster stocks, today's harvests are one percent of levels forty years ago. Closely associated with the decline of the oyster population is the destruction of three dimensional oyster reefs due to commercial harvest of oysters for their meat, the harvest of oyster shell as road substrate, and the clearing of navigational obstructions. In response, the states of Maryland and Virginia in cooperation with the United States Federal Government have been investigating several options to restore the oyster populations; one of which is the creation of artificial reef substrate combined with an aggressive seeding program. The high costs related to reef creation are relatively easy to estimate (almost US$15 000/acre for a total of approximately US$30 million) but the benefits (e.g. oyster resource, finfish habitat improvements, overall ecosystem productivity) are more difficult to evaluate. Therefore, estimates of the benefits of reef restoration are necessary to determine a positive benefit-cost ratio of such projects.

The analysis – A subset of the beneficiaries of an improved oyster reef project included angler reef fishers through potentially improved catch or water quality. The study first linked the policy variable (creation of oyster reefs) to anglers' preferences for fishing, then use a travel cost model to estimate the willingness to pay per trip for an oyster restoration project under two scenarios: the first in which historical catch rates do not change and the second in which stock level increase. In both cases, it is assumed that the number of trips/angle would remain constant.

The results – Total annual willingness to pay by recreational fishers in the Chesapeake Bay was estimated for the two scenarios at approximately US$638 000 and $5 000 000, respectively. Under the first scenario, the anglers' willingness to pay would cover 50 percent of the total restoration costs within thirty years. Under the second scenario (albeit highly speculative) the full restoration costs would be covered within less than five years.

Source: Hicks *et al.*, 2004

Case study – Group-based evaluation of ecosystem services: Plum Island, Massachusetts (United States of America)

The situation – Natural and human-based changes have affected the capacity of an estuarine drainage basin to provide ecosystem services, such as gas, disturbance, and water regulation, water supply, food production, recreation, aesthetics, and spiritual and holistic services. Several management alternatives could be used to address various objectives each with related tradeoffs, such as increasing water supply while maintaining adequate river flow, preserving open space, and maintaining a productive estuarine clam fishery. Two such alternatives are analysed through a services-based approach: business as usual and replumbing sewer and stormwater systems.

The analysis – The effects on ten ecosystem services are scored from -3 to 3 for both the business as usual and the replumbing alternatives. Weights, from 0 to 3, are used to rank each service in terms of its importance. A "value" of each service change is then estimated as the weighted sum of the changes in services.

The results – While the total score for each scenario was negative (-94 for business as usual and -67 for replumbing), the results suggested that replumbing, which would allow continued suburbanization but with adequate river flow, avoids more losses in services than the business as usual scenario. Specific valuation of each service would need to be undertaken; however, such a matrix allows for a relatively inexpensive ranking of scenarios, importance weighting of ecosystem services, and the inclusion of both quantifiable and non-quantifiable values.

Source: Farber *et al*., 2006

3. Policy, legal and institutional frameworks

POLICY FRAMEWORKS AFFECTING EAF

The ecosystem approach to fisheries is not an end in itself, but rather a mechanism intended to help better achieve societal objectives through producing more responsible fisheries, and in particular through broadening conventional fisheries management into an integrated, participatory framework that takes better account of the interaction of fisheries with aquatic ecosystems, as well as with interacting human uses.

As such, EAF interacts with other approaches that have been implemented, or are emerging, in the world's fisheries – such as the precautionary approach and co-management approaches – as well as interacting with international conventions (such as the Convention on Biological Diversity), regional initiatives (such as Regional Fisheries Management Bodies) and particular national legal and regulatory frameworks. This section reviews some of these interactions, from the perspective of policy considerations, while the following section of this chapter focuses on institutional aspects of the relevant linkages.

The specific policy frameworks and approaches discussed here are:

- Millennium Development Goals
- Precautionary approach
- Management and co-management approaches
- International policy frameworks
- "Pro-poor" policies

Millennium Development Goals

The Millennium Development Goals impact significantly on policy priorities globally, in particular renewing the focus on seeking an appropriate balance of human development and environmental conservation – a balance that developed from the Brundtland Commission and on through the Rio Declaration and Agenda 21, now being reflected in the Goals themselves:

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Improve maternal health
- Combat HIV/AIDS, malaria, and other diseases
- Ensure environmental sustainability
- Develop a global partnership for development

Implementation of EAF fits closely within the balance noted above, in that it seeks (1) to ensure the sustainability of fishery use, i.e. of the benefits to people accruing through fishery activities, in particular by ensuring that fishing practices do not compromise ecosystem health and by limiting negative impacts on fishery ecosystems arising from outside the fishery sector, while (2) being implemented in keeping with societal objectives, however defined (and often reflecting many of the above Millennium Development Goals, such as poverty reduction and food security).

While EAF is certainly broadly compatible with these goals, it is nevertheless important to assess the benefits and costs of EAF implementation with respect to

these goals. In other words, any given policy or operational management mechanism to implement EAF may have positive impacts on one or more of the goals, but may also have costs involved. A wide range of possibilities may arise. It is possible, for example, that an initiative to protect a depleted population of a certain species, through EAF measures, would produce positive results in terms of goal #7 (Environmental sustainability), but may restrict harvesting activities so that (at least in the short term) the catch of other species is reduced, which could have a negative impact on goals #1 and #4 (Eradicate extreme poverty and hunger, Reduce child mortality). Alternatively, a "win-win" EAF measure, such as reducing unwanted bycatch in offshore fishing activities, may be positive on all counts – improving environmental sustainability while also improving the food supply in the short term (there being immediately more fish available to small-scale coastal fishers) and in the long term (with less pressure on bycatch species, leading to stock rehabilitation).

Precautionary approach

The precautionary approach (Garcia, 1994; FAO, 1995a) provides a policy and management framework for dealing with the various forms of uncertainty faced in fisheries management (Francis and Shotton, 1997; Charles, 1998b and 2001). Aspects of this range from appropriate risk assessments to robust and adaptive fishery management methods, to appropriate institutions capable of implementing such a management approach. As FAO (1995a, p.6) notes:

> *Management according to the precautionary approach exercises prudent foresight to avoid unacceptable or undesirable situations, taking into account that changes in fisheries systems are only slowly reversible, difficult to control, not well understood, and subject to change in the environment and human values.*
>
> *Precautionary management involves explicit consideration of undesirable and potentially unacceptable outcomes and provides contingency and other plans to avoid or mitigate such outcomes. Undesirable or unacceptable outcomes include overexploitation of resources, overdevelopment of harvesting capacity, loss of biodiversity, major physical disturbances of sensitive biotopes, or social or economic dislocations. Undesirable conditions can also arise when a fishery is negatively influenced by other fisheries or other activities and when management fails to take action in the face of shifts in the external conditions affecting, for example, the productivity of the fish stocks.*

Some aspects of implementing the precautionary approach are analytical in nature. For example, a major focus of attention in fisheries has been on efforts to operationalize the precautionary approach in terms of determining and setting suitable limits on catch, fishing mortality or fishing effort. This involves a combination of *risk analysis* and *risk management*, with methods such as management procedures providing analytical frameworks to support the implementation of a precautionary approach.

Equally important is the implementation of the precautionary approach at a policy level. This deals not with analytical matters but rather with the various assumptions and approaches underlying fishery decision making – and how to determine suitable "rules" *governing* decision making (as opposed to decision rules *per se*). This involves questions of the *burden of proof* and the *standard of proof*, the latter relating to "the responsibility for providing the relevant evidence and the criteria to be used to judge that evidence" (FAO 1995, p.6). Specifically, "the standard of proof to be used in decisions regarding authorisation of fishing activities should be commensurate with the potential risk to the resource, while also taking into account the expected benefits of the activities".

Properly putting the precautionary approach into practice requires new information and research. For example, the FAO (1999a) has described a number of implications on the work of Regional Fishery Bodies, e.g. that "uncertainty should be systematically investigated", "outputs should be identified corresponding to objectives", "target and limit reference points should be established", "robustness of management regime to (a)

overfishing and (b) environmental change should be assessed" and "contingency plans should be developed".

The link between the precautionary approach and the ecosystem approach is a logical one: the first calls for suitable use of precaution in decision making, while the second calls for suitable breadth in what is considered within the decision-making. Together, the two approaches imply a significant challenge – to assess and manage a set of uncertainties and risks, but at a broader scale and with a broader scope, covering a range of possibilities larger than what would have been considered in conventional fishery management.

A key benefit of this combination lies in the inherent desirability of integrating approaches for addressing two major realities of fisheries – uncertainty (the precautionary approach) and complexity (the ecosystem approach). On the other hand, there can be costs as well. One such cost arises as a result of combining the greater information needs implied in implementing EAF management (relative to conventional fishery management) and the reality that such a level of information is often unavailable. In this case, the manner by which one applies the precautionary approach becomes a key issue. For example, in the extreme, being highly precautionary within a situation of great ignorance (e.g. a lack of information on all aspects of the ecosystem) could be accompanied by the risk of high costs arising from foregone economic activity and livelihoods, and lowered food security.

From the perspective of social, economic and institutional considerations involved in EAF implementation, the precautionary approach implies a need to take into account a broad set of risks, including (a) those that might arise in fishery use, in terms of environmental impacts, (b) those posed by aspects outside the fishery, such as other economic sectors, but which might impact negatively on the fishery, and (c) those that arise in EAF implementation itself, such as the risk of possible negative social or economic impacts from changes initiated to meet EAF goals.

Management and co-management approaches

The nature of fishery management systems evolves over time, drawing on lessons from history and on trends in management and governance in the broader society. Four aspects of management and governance, and their interaction with EAF implementation, are noted here: the particular jurisdiction that is responsible for management, the degree of centralization or decentralization of management, the degree of integration within the management approach, and the breadth of participation of stakeholders in fishery management.

1. There are many variations around the world in how fisheries management fits within a governmental system. In many locations, fisheries management is a national responsibility, and is found within a ministry of fisheries, or as a component of a ministry of agriculture. In other locations, fisheries management may be a responsibility at a provincial/state level, or (as for coastal fisheries in the Philippines) at a local, municipal level. Whether or not fishery management – or at least some management functions – has been partly or largely devolved to industry or community entities (see below), government will be involved in a coordinating or policy-level role, and in particular, within EAF management, there is an important role in interdepartmental and/or intergovernmental linkages with respect to the impact of fisheries on the aquatic environment and the impacts of other aquatic (and land-based) activities – from aquaculture and shipping to tourism and agriculture – on fish stocks and on fisheries. There are implied benefits from such policy and operational coordination, although it is important to assess the costs involved in this as well.
2. The ecosystem approach to fisheries management must be able to be implemented both in fisheries that are managed by a central agency and

ones in which management is decentralized, as well as combinations in-between. However, whether the fishery management system is centralized or decentralized, it still must deal with ecosystems of varying sizes and scales – it is not the case that central management need only deal with larger-scale ecosystems, or conversely, that a decentralized management arrangement must only deal with smaller-scale ecosystems (e.g. on a more local basis). The fact is that any management system will need to approach EAF implementation based on the scale needed to address each problem arising. This certainly has implications for the linkage between decisions about boundaries (for ecosystems versus for jurisdictions) and about scale (how large should be the area considered in an EAF process, to be compatible with both the ecosystem realities and the management regime in place?). This in turn implies a need – whatever the degree of management centralization – for mechanisms to scale-up or scale-down management decision making. There will also be questions of the efficiency of the management arrangement – which may interact in rather complex ways with the level of centralization and the level of EAF implementation. In any case, EAF is applicable to all fisheries systems, and its implementation must be compatible with a recognition of the variety of different fishery systems that exists.

3. The structure of the fisheries management agency, and the fisheries science infrastructure, must be taken into account in considering EAF implementation. The FAO approach to EAF implementation has been to build on existing management structures and processes. The nature of these existing structures and processes will affect the benefits and costs, and the time frame, of EAF implementation. For example, if management and/or scientific aspects are carried out on a species-by-species basis, a mechanism is needed either to transform this into an ecosystem approach, or to "scale down" EAF implementation to provide some elements of an EAF even within a single-species approach to management and science. A shift from a single-species to a multiple-species approach is to be encouraged, but there may be constraints to this that cannot necessarily be overcome in the short term.
4. Also relevant to EAF implementation is the degree of stakeholder involvement in the fishery management system. The FAO Guidelines on EAF call for the use of participatory approaches within EAF management, but the degree to which this exists varies from fishery to fishery – according to the extent to which ***co-management*** and participatory research have been introduced. The idea of co-management is the creation and implementation of management arrangements through which a set of agreed-upon stakeholders – fishers, fisher organizations, communities, corporations, nongovernmental organizations or other entities – share decision making and management functions with government, and work jointly to develop and enforce fishery regulations and management measures (Charles, 2001). There are many nuances to the co-management concept, some displayed in the following mutually-compatible descriptions of co-management:

   > *…an arrangement where responsibility for resource management is shared between the government and user groups.* (Sen and Nielsen, 1996, p. 406)
   >
   > *…the collaborative and participatory process of regulatory decision-making among representatives of user-groups, government agencies and research institutions.* (Jentoft *et al*., 1998, p. 423-4)
   >
   > *…various degrees of delegation of management responsibility and authority between the local level (resource user/community) and the state level (national, provincial/state, municipal).* (Pomeroy, 1995, p. 150)

> *…a partnership arrangement using the capacities and interests of the local fishers and community, complemented by the ability of the government to provide enabling legislation, enforcement and conflict resolution, and other assistance.* (Pomeroy and Berkes, 1997, p. 465)

Those involved in co-management have both rights and responsibilities, with the rights in this case being management rights – the right to be involved in design and implementation of management measures. The motivation for co-management initiatives includes their potential (1) to reduce conflict between stakeholders and government, as well as between stakeholders themselves, by clearly defining rights and responsibilities, by providing an institutional forum for discussion among decision makers, and by encouraging support for the management process, and (2) to build a conservation ethic, by bringing fishers and others into the decision making process, so they share responsibility for sustainability in the fishery.

The co-management approach can be applied at any scale, from that of a single component (fleet sector, gear type, geographical area) of a single fishery, through to multistakeholder multiresource multiuse situations, as arise within the context of integrated management. Implementation of EAF – typically involving interactions of a fishery with its environment, interactions among a range of fisheries, and/or interactions with sectors impacting on (and affected by) the fisheries – thus can utilize a co-management approach, albeit with potentially greater challenges than might be faced in a simpler within-fishery context.

These challenges may arise through the need to develop suitable policy for cooperative management within an enlarged forum (e.g. between fisheries rather than only within a single fishery), as well as suitable institutions within which this can occur. Of course, it should be noted that even in a management system operating completely at the governmental level (i.e. without co-management) similar issues of coordination arise with respect to implementation of EAF, since – as noted earlier – multiple ministries of government will need to interact together (even if EAF is led by a fisheries agency).

International policy frameworks

Some policy initiatives discussed above – notably the Millennium Development Goals and the precautionary approach – arise from or are closely related to international conventions or policy discussions. Certainly, a number of international conventions, such as the Convention on Biological Diversity, influence the fishery policy environment. However, as noted in FAO (2005a):

> *At the international level, EAF is reflected mainly in voluntary instruments such as the Rio Declaration, Agenda 21, the FAO Code of Conduct for Responsible Fisheries, the Reykjavik Declaration and the 2002 Plan of Implementation of the World Summit on Sustainable Development.*

Also relevant to EAF implementation are UNCLOS and the UN Fish Stock Agreement, as well as the World Trade Organization and a range of trade agreements.

At the regional level, the various regional fishery bodies (RFBs)/regional fishery management organizations (RFMOs) play a key role in EAF implementation on scales above the national. In recent years, RFBs have begun incorporating references to the EAF in their Conventions or Agreements[16], creating subcommittees and working groups on the EAF, implementing regional EAF projects, and co-operatively developing and adopting EAF objectives; however, progress has been slow towards incorporating EAF considerations into RFB decision-making (FAO, 2007a).

[16] Note that the 1980 Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) Convention comprised many of the EAF principles.

Since EAF management requires changes to conventional fishery management approaches, whether those changes are incremental or not, it is clear that at regional and global levels, in addition to those at the national and sub-national levels, there will be a need to assess a range of benefits and costs in order to determine how, when and to what extent EAF management is implemented. There may also be a need for adjustments to legal instruments at each of these scales, to enable adequate realization of EAF management. At all scales, these changes will imply certain costs being incurred, as well as a need for adequate time for implementation.

"Pro-poor" policies

The FAO (2005b) has produced, as part of its Technical Guidelines for Responsible Fisheries, a document on *Increasing the contribution of small-scale fisheries to poverty alleviation and food security*. This describes considerations relating to small-scale fisheries and their role in poverty alleviation and food security, including a range of supportive "pro-poor" policy directions. The document notes that:

> *Small-scale fishing communities are faced with an array of serious problems, including overexploitation and depletion of resources, lack of alternative sources of employment, rapid population growth, migration of populations, displacement in coastal areas due to industrial development and tourism, pollution and environmental degradation and conflicts with large commercial fishing operations. However, small-scale fisheries are critical for food security and poverty alleviation in many countries.*

Of relevance to the ecosystem approach to fisheries is the emphasis in the Guidelines on a broad view of the fishery; noting, for example "the importance of considering cross sectoral uses of fisheries and related resources, the special role of women in fish marketing, processing and value addition, the significant scope for trade…".

The 2005 Guidelines present many policy directions for "pro-poor policies", noting that "all of these issues may need to be legislated for to ensure that certain *rights* are enshrined in law for small-scale fishers and fishworkers so that they cannot be eroded through social, economic and political marginalization" (p. 27). Of particular relevance to how EAF is developed is the statement: "The increasing importance of decentralization in many regions of the world is worthy of special mention in the legislative context. It is important in bringing decision-making closer to the poor and therefore increasing the likelihood of success of pro-poor policies and programmes" (p. 29).

INSTITUTIONAL AND LEGAL FRAMEWORKS AFFECTING EAF

In moving from conventional fisheries management towards an ecosystem approach to fisheries management, some changes to current institutional and legal frameworks are likely necessary. In this document, the term "institutional framework" refers to both the set of rules governing fisheries resources use and the specific organizational arrangements involved in the formulation and implementation of fisheries resources laws, policies, strategies and programmes. These changes include ways of taking account of, and dealing with, the increased scope of this management approach. Such an increased scope conveys the need for:

- increased coordination, cooperation and communication within and among relevant institutions and resource user groups in the planning process and in implementation;
- more information regarding the ecosystem and the factors affecting it;
- incorporation of uncertainties into the decision-making process due to the increase of factors (predator-prey relationships, nearby activities such as agriculture, and their impact on the ecosystem etc.) causing uncertainties; and
- ways of involving the broadened definition of stakeholders in the decision-making and management.

Good governance

Guiding the prospective adaptation of the institutional and legal frameworks, to an ecosystem approach to fisheries management, should be the idea of "good governance". Governance is a term describing how political, economic, administrative and other forms of power or authority is exercised to manage a country's resources and affairs. Thus governance comprises the mechanisms, processes and institutions through which citizens and groups voice their interests, mediate differences, exercise their legal rights and meet their obligations (AusAID, 2000). This broad term is used to explain, amongst other things, to what extent governments are accountable to, and allow participation by, the public (Coffey, undated).

While the concept of "governance" is descriptive, the idea of "good governance" is *standard-setting*, i.e. normative in nature. The exact meaning of "good governance" varies according to the policy area in question but the general principles of good governance are seen to involve (UNESCAP, 2007; OECD, 2007): accountability; transparency; responsiveness; effectiveness and efficiency; rule of law. The OECD (2007) expands on these five aspects as follows:

- Accountability: the governing body should be able and willing to show the extent to which its actions and decisions are consistent with clearly-defined and agreed-upon objectives.
- Transparency: the governing body's actions, decisions and decision-making processes should be open to an appropriate level of scrutiny by other parts of government, civil society and, in some instances, outside institutions and governments.
- Responsiveness: the governing body should have the capacity and flexibility to respond rapidly to societal changes, and take into account the expectations of civil society in identifying the public interest, and should be willing to critically re-examine the role of the governing body.
- Efficiency and effectiveness: the governing body should strive to produce quality public outputs, including services delivered to citizens, at the best cost, and ensure that outputs meet the original intentions of policymakers.
- Rule of law: the governing body should enforce equally transparent laws, regulations and codes.

Further principal elements of "good governance" are: consensus-orientation, participation, equality and inclusiveness, decentralisation (UNESCAP, 2007; Coffey Undated), and forward vision, the latter implying the governing body's ability to anticipate future problems and issues based on current data and trends and develop policies that take into account future costs and anticipated changes (e.g. demographic, economic, environmental, etc.) (OECD, 2007).

Good governance is an element needed in implementation of EAF management. In fisheries, where management and exploitation occur largely out of public view and scrutiny (even given that the fishery is often managed by the public sector), accountability is of great importance. As a means of ensuring accountability, access to information and transparency in policy are critical. This access is also a precondition for meaningful public participation in decision-making. Policy effectiveness can be improved by decentralised management, as measures can be tailored to local needs and increased opportunities be given local stakeholder participation in decision-making (Coffey, Undated). In terms of the legal framework for good governance within fisheries management, the FAO Code of Conduct on Responsible Fisheries, although non-binding, refers to the need for increased transparency within the decision-making processes and to ensure that timely solutions to urgent matters are achieved. In addition, states are called upon to facilitate consultation and effective participation in decision-making (Article 6 of the Code) (Coffey, Undated).

Nested institutions

If governance describes how a resource sector, fisheries in this case, is governed, and the principles of good governance suggest the ways in which a resource *ought* to be governed, then an understanding of how institutions interrelate is vital in moving forward. Such an understanding will assist in highlighting *negative* interrelationships as well as the interrelations that contribute positively to governance.

It is suggested that institutions operate at multiple levels of jurisdiction (Scott, 1995, in Hersoug, 2004) and that they work at different levels of society. Because they are linked to each other, and thus form networks, they should be analysed as open systems, which receive impulses from the outside, i.e. from other institutions, in the form of impacts, resources and ideas (Scott 1992, in Hersoug, 2004). As they do not "exist in a cultural, social and institutional vacuum", institutions are never fully self-controlled (Hersoug, 2004: p. 212). This conclusion is of importance when considering institutional adaptation to EAF management, as any successful change requires understanding of how the institutional system really works and which factors need to be considered.

An institutional system can be divided into two levels – a practical level and a higher, political level. Institutional change may originate at both levels. If, for example, technological change has undermined *established* institutions at the practical level, corrective actions may be needed at the political level. More general institutional reform may originate at the political level, which could convey changes to institutions at the practical level which were, in their original form, considered legitimate by their main users. Sometimes a required reform at the practical level needs to await a shift at the political level in order to take place. Institutional change may also occur at the practical level, without it being noticed *or sanctioned* at the political level. Importantly, however, there will be rules structuring the relationship between the levels, deciding for example which issues at the practical level will be considered at the political level, the procedures for this, who is allowed to participate in decision-making, etc. (Holm, 1995).

A high degree of interconnectedness between institutions can produce dynamic change patterns – changes in one part of the system may have effects on other parts of the system and a new balance may be established. Likewise, a small change in one part of the system may lead to cumulative effects on the system as a whole. For example, by allowing an increased scope of stakeholders to participate in the decision-making procedures, greater changes to the system of management institutions may be felt to be required in order for it to be viewed as legitimate. On this matter, it is also relevant to highlight the point made by Easter and McCann (2007) that "Informal institutions such as norms and culture affect which laws and policies can be implemented. …changes in formal institutions that contradict norms are unlikely to be successful." (p. 10-11).

Within organizations

As a way of identifying problem areas in the institutional framework in relation to the attainment of good governance, the field of organization theory can give some insight into what it is about organizational behaviour that gives rise to unsustainable natural-resource policies and practices (Ascher, 2000). In terms of lessons that may be useful for EAF management, organization theory suggests the need (Ascher, 2000) to:

1. establish simpler, non-competing mandates for agencies;
2. provide information to many governmental and non-governmental actors;
3. Restructure intra-governmental arrangements to reduce the opportunities for interagency jurisdictional conflicts;
4. restructure organizational incentives to create longer time horizons for agency leaders and personnel;
5. liberalize to reduce rent-seeking alliances that promote corruption.

Chapter 7 will specifically address adjustments to current institutional frameworks in the move towards EAF management. Two key questions to be addressed are:

1. What kind of new institutional mechanisms are warranted, or how would existing institutions need to change, in order to facilitate an implementation of the EAF?
2. What examples are there of the practical use of EAF-friendly institutional mechanisms or frameworks?

CONCLUSIONS

As mentioned in the beginning of this chapter, EAF management is not an end in itself but simply a mechanism in moving towards sustainably managed fisheries. The discussion above on the policy, institutional, and legal frameworks of the ecosystem approach to fisheries management, has set out the context within which this broader management approach is to take place. In the discussion, general ways forward have been suggested, and problem areas highlighted. Whether a desirable result is achieved or not, will however depend on the success of implementation. However, success will be more likely given an ability to work within broadly accepted policy frameworks, and to develop or reinforce institutional and legal arrangements that allow for good governance, for effective nested institutions (outside and between institutions), and for appropriate organizational structures (inside institutions and/or agencies). In addition, there will always be a need to deal with problems arising through gaps between policy and management (e.g. lack of capacity), legal failure and a lack of compliance (e.g. due to lack of capacity), and the possibility of institutions being affected by power and politics. All these aspects form the reality within which EAF implementation must take place.

4. Social and economic considerations

INTRODUCTION

The ecosystem approach to fisheries (EAF) management has been advocated widely, on the basis of its potential to meet a range of broad objectives relating to ecosystem health, biodiversity conservation, and sustainable natural resource use, among others. These general benefits can in turn be broken down into more specific benefits, including those relating particularly to human considerations, such as greater employment and income generation as a result of rehabilitated ecosystems, reduction in the risk of fishery collapses, aesthetic benefits, etc. At the same time, there are potential costs involved in implementing EAF, ranging from direct costs of implementation (e.g. increased management costs) to possible indirect or induced costs, resulting from how the EAF is implemented (e.g. reduced employment and/or revenues in the short term, as well as ethics and equity-related considerations).

Accordingly, this chapter discusses some of the social and economic considerations that can influence the form and extent of EAF implementation. The particular aspects discussed here include: (a) employment, livelihood and regional effects; (b) impacts on poverty levels, e.g. resulting from changes in income or employment; (c) impacts on food security, e.g. resulting from short-term decreases in catch levels, if they occur in shifting to an ecosystem approach to fisheries management; (d) cultural factors that may affect EAF implementation; (e) use of traditional knowledge and management practices; and (f) impacts on the distribution of benefits and costs related to EAF implementation.

Of course, the overfishing and ecosystem degradation that typically underlie the need for EAF result in immediate economic losses for the fisheries, and a disruption of livelihoods, community well-being and traditional ways of life. Likewise, applying the ecosystem approach, while aiming to contribute to sustainable development in the longer term, will also undoubtedly result in costs, at least in the short term – particularly since one implication may be a reduction of fishing effort and output. However, there are also possible long term social benefits such as an improved quality and diversity of fish stocks (e.g. increased size of individuals and greater abundance of higher value species). Improved quality may, for example, lead to increased income for fishers. Actual impacts on effort and catch will depend on many factors, including the nature of the ecosystem and the state of exploitation at the time of implementation of EAF.

This chapter attempts to raise some social and economic issues that may need to be addressed in the application of EAF, such as the social impacts of any decreases in fishing effort that may prove necessary. In examining these issues, one should keep in mind that the implicit assumptions in moving to EAF management are: 1) that in the long term, EAF will promote the attainment of the ultimate objectives, such as reducing poverty and hunger; and 2) that failing to implement EAF will eventually have serious negative impacts on those whose livelihoods depend on aquatic resources. Furthermore, it is useful to note that the FAO Code of Conduct for Responsible Fisheries (FAO, 1995b), in highlighting the relationship between fisheries and food security, and the need for transparency in decision-making processes and for effective participation of interested parties, provides helpful guidance on the social aspects of applying the EAF.

THE PARTICULAR SITUATION OF ARTISANAL AND SMALL-SCALE FISHERIES

In the developed as well as in the developing world, artisanal and small-scale fisheries serve important roles in terms of providing employment, income and food security, as well as maintaining cultural/traditional practices (Berkes *et al.*, 2001). Their key role has been acknowledged in the above-noted FAO Code of Conduct:

> *6.18 Recognizing the important contributions of artisanal and small-scale fisheries to employment, income and food security, States should appropriately protect the rights of fishers and fishworkers, particularly those engaged in subsistence, small-scale and artisanal fisheries, to a secure and just livelihood, as well as preferential access, where appropriate, to traditional fishing grounds and resources in the waters under their national jurisdiction.*

Five key points that have been raised pertaining to implementation of EAF in the context of small-scale fisheries in developing countries are as follows:

- For developing countries, there is a particularly great need for fisheries management to focus on and take into account the human dimension in the fisheries sector. As fisheries in coastal areas in developing countries contribute to poverty alleviation and food security, it is difficult to reduce the fishing fleet, especially as the State might have scarce resources for creating alternative employment. Coastal fisheries may also constitute a better opportunity for people in other areas, with occupations that cannot provide a basic livelihood, thus leading to migration into fishery areas, as experienced, for example, in countries such as China, India, Madagascar, Peru and Senegal (Mathew, 2003).
- Small-scale fisheries, even those that financially generate only marginal profit levels, may have significant comparative advantages over industrial fisheries in the form of greater economic efficiency; fewer negative impacts on the environment; a wider distribution of economic and social benefits (being geographically more spread out and decentralized); and their contribution to cultural heritage, including ecological knowledge (FAO, 2005b).
- Although small-scale fisheries most often are focused on supplying fish and fishery products to local and domestic markets, and for subsistence consumption, export-oriented production has increased in many of these fisheries during the last one to two decades as a result of greater market integration and globalization. For example, fisheries products, especially from the small-scale subsector, are one of the few areas where African, Caribbean and Pacific countries have seen their share of world trade increase (Mathew, 2003; FAO, 2005b).
- It has been noted that from an ethical point of view, applying the ecosystem approach globally will require that industrialised countries take some responsibility – for example, by not selling their excess fishing capacity to developing countries at low prices, or giving it away as an article of aid. On the contrary, establishing an "international fisheries management assistance fund" has been proposed to support developing countries in the management of overexploited fisheries in a consultative manner, using the ecosystem approach as a framework (Mathew, 2003). For example, financing from development banks and development-oriented financial institutions could be a way of easing many small-scale fisheries' transition towards a more sustainable use of living resources (FAO, 2005b). At the same time, where feasible, it will be helpful for governments in developing countries to invest more in fisheries management from existing revenue resources, particularly in cases where net earnings from fisheries exports are high. Accompanying this is a need for dissemination of information regarding the value of the resources, and a need for education in order to explain how an ecosystem approach can improve the state of the resources (Mathew, 2003).
- A key challenge for small-scale fisheries in applying the EAF is dealing with impacts caused by factors beyond their control, or outside their territories, such as pollution and habitat destruction from land-based activities, destructive

practices of non-fishery activities within aquatic environments (e.g. impacts of oil exploration and extraction and offshore mining activities), and destructive fishing practices by large-scale fisheries. An example of the latter is when industrial fishing vessels encroach on inshore areas previously only used by traditional fishers, in order to make up for a shortage of resources in their original territory. Possible implications of this include a reduction of resources, destruction of fishing gear, damage of habitats, etc. Such implications could result in an added economic burden to the small-scale fishers, ranging from needing to replace gear, through to a loss of livelihood (FAO, 2005c).

EMPLOYMENT, LIVELIHOOD AND REGIONAL ASPECTS

Shifting fisheries to EAF management, with its broadened attention to ecosystem effects and interactions with other economic sectors, may well have impacts on employment, livelihoods and regional economies. While in some countries, the fisheries sector contributes relatively low proportions of national employment and economic activity, the regional implications within a given nation of a transition towards responsible fisheries may be more severe, as employment tends to be concentrated where few livelihood alternatives exist (OECD, 1997). This is a major issue when an EAF leads to reduced levels of employment, and indeed labour stickiness, few employment alternatives and low education levels are some of the obstacles for a smooth transition in these regions (OECD, 1997).

Impacts on employment stem from the need to reduce fishing effort, which might be carried out through direct controls on effort (input controls) or indirectly through output controls, or with technical measures, including closed areas, etc. Below are some examples of employment impacts of input and output controls:

1. Direct effort controls may result in immediate reductions in employment, if the limits on effort are applied in terms of labour inputs, or applied to all inputs. On the other hand, if effort is reduced by decreasing capital inputs rather than labour inputs (e.g. by shifting to less capital-intensive vessels), employment may not be much affected.
2. An output control in the form of a Total Allowable Catch (TAC) that is set below current harvest levels will initially lead to a decline in harvesting employment, to the extent that such a quota induces less fishing activity (as opposed to merely inducing highgrading of the catch). However, as the stock recovers, effort will likely increase along with employment, perhaps to above the previous level. If a TAC limit applies at the same time as a "race-to-fish" occurs, there could be a shortening of the fishing season, leading to a situation with higher employment in numbers but of shorter duration. With individual quotas, there will also be initially reduced employment as the TAC decreases. This will be exacerbated, if quotas are transferable in the marketplace; a concentration of control in the fishery can lead to extensive employment losses (although such losses may be reduced somewhat in the long run by a possible lengthening of the fishing season). Another form of output control is that of individual, or vessel, catch limits restricting landings per day, week or month. While the effect of catch limits of this sort on fleet size and harvest employment are not definitive, such an approach may have the stabilizing benefit of providing a mechanism for equitable access to fishery resources, one that may favour small producers over large, thereby protecting owner-operated fishing vessels (OECD, 1997).

Employment impacts, particularly in fishery-dependent regions, are driven by characteristics of the labour force:

- In some regions, there are few employment alternatives for fishers, and where alternatives do exist, these may require employees with higher levels of education than that held by the fishers. While only a few countries have published sector-

specific data on the level of education among fishery workers, this data does suggest that the assumption of low-level education amongst fishers is correct (OECD, 1997). Of course, in addition to their level of formal educational attainment, the fishers may have informal learning and experience that equips them with skills of use in other sectors.

- The average age of fishery owner-operators is often greater than that found in the working population at large (although the average age of hired workers is not significantly different from elsewhere) and re-employment in another occupation becomes more difficult the older a person is (OECD, 1997).
- The level of labour-stickiness is high in such areas due to strong roots in community or (family) tradition, reducing the willingness to move in order to find similar or alternative employment elsewhere, and thus also making it more difficult to reduce fishing effort (OECD, 1997).
- While adjustment to reduced fishing effort levels may be feasible if there is a functioning social security system or some kind of adjustment programme, poorer countries and regions may not have the same possibility of providing such aid to their fishers. [In OECD member countries, for example, adjustment problems have been approached through such means as extended-term unemployment benefits for younger workers; programmes for retraining; early retirement packages for older fishermen whose vessels have been withdrawn; and investment in infrastructure, tourism and other regional and rural development (OECD, 1997).]

Changes to fisheries in the course of implementing the EAF may have more widespread effects than just in the fishers' livelihoods (FAO, 2005b). This is because changes in demand and production have impacts not only on producers themselves, but also indirect impacts through the commodity supply chain. This includes the supply of inputs to the fishing operation through "upstream" activities such as (a) investments in vessels, engines and gear, (b) operational costs (fuel, ice, food, bait; labour costs), and (c) maintenance costs, as well as through "downstream" activities following the harvesting.

There can also be major interactions of gender and employment that influence the nature of EAF-related impacts. In terms of "downstream" activities, such as post-harvest processing of fish and fishery products, as well as marketing, women often play a predominant role (TABFM, 2006; FAO, 2007b). Impacts of implementing EAF management on the "downstream" activities, e.g. by a reduction in employment opportunities caused by a change in the fishery management regime, may thus affect food security *indirectly*, as women tend to spend more of their income on feeding their families than men (see case studies in Argentina, Brazil and Uruguay: Josupeit, 2004). Women also tend to be less educated, and less able to migrate for work due to social/cultural/traditional/religious reasons, thus further reducing their mobility in terms of labour.

Boxes 2 and 3 provide an example of the livelihood consequences of conservation measures and a brief outline of the sustainable livelihoods approach to fisheries, as an example of an approach that can be used when attempting to understand the nature of people's livelihood opportunities.

In summary, attention to alternative livelihoods is of crucial importance in moving to an EAF, and more generally to changing towards more sustainable fishery practices, by reducing the number of people dependent on fishing as their sole income and thus reducing barriers to change. However, there is no easy answer to the challenge of introducing alternative livelihoods in situations of fishery dependency – barriers such as labour stickiness and low levels of education among the fishing population have to be acknowledged, as does the reality that no single "solution" will work in all circumstances. Undoubtedly, a customized approach must be adopted.

BOX 2

Example of livelihood consequences of conservation measures in India

An example of a dire consequence of not taking into account the social aspects when deciding to protect endangered species is the case when some fishermen in Orissa, a state in India, committed suicide over a fishing ban. This ban was imposed by the state government to protect the Olive Ridley turtles in the Gahirmata Marine Sanctuary, by prohibiting fishing for six months of the year within a five km radius of the Bay of Bengal, in the coastal districts of Kendrapa and Jagatsingphur.

The fishing communities accuse the government of being indifferent to their need for alternative livelihoods, yet the government officials claim they are aware of the implications and that efforts are being made to provide for such alternatives, however, they also have a duty to protect these turtles. As a result of reduced fishing possibilities, and through that reduced income, ten fishermen have been reported to have committed suicide. Now whole families are left behind without a bread earner. There is also a risk that the problem will increase as another ban will be imposed in July as this is the time for the breeding season. In desperation people have made attempts of fishing within the prohibited area, however, a number have been arrested and their boats seized.

This case shows the importance of making some kind of social impact assessment before introducing a conservative measure. An ecosystem approach would suggest that the human needs also need to be considered and thus, if a measure reduces certain livelihood possibilities, alternative livelihoods ought to be created. However, the possibility for such efforts are seldom great, and even less so in developing countries.

Source: NewKerala, 2006

POVERTY AND SOCIAL SECURITY/SERVICES

Poverty can be viewed both as impacted by inadequate fisheries management (a result of depleted fish stocks, etc.) and as a constraint in improving fisheries management. The constraint stems from the fact that it is not typically considered to be reasonable to exclude poor people from fishing without creating alternative sources of food and livelihoods. Neither can the reality of poverty in fishery-dependent communities be necessarily resolved through fisheries management, since it is not always directly related to the resource or catch levels. For example, poverty can also be observed in remote fishing villages where fishers catch and trade reasonable volumes of fish, but where access to health and other public services is lacking and the community is politically un-represented (FAO, 2005b).

It has been noted that while fishing may not necessarily generate high economic returns, for a majority of households, fishing activities have simply provided them with a way to sustain their livelihoods, preventing them from becoming poorer. From an economic perspective, there may be no resource rent generated by such activities, but from a social point of view this way of providing livelihoods is vital. In areas where alternative employment is scarce, and where social security is less than common, fisheries constitute a kind of welfare system by way of reducing dependency and vulnerability (greater exposure and sensitivity to risk). The vulnerability of households – for example, a family head's loss of job may lead to sudden reduced income – implies that fisheries, as additional or alternative sources of income and food, are extremely important (FAO, 2005b).

This implies a major dilemma arises in implementing EAF management. On the one hand, it is the open-access state of the fishery which is the main mechanism providing the above safety net, as it allows people the opportunity and flexibility to engage in

BOX 3

Sustainable livelihoods approach to fisheries

As mentioned in Chapter 1, a sustainable livelihoods perspective may be useful in the application of the EAF as it highlights people's livelihood situations, the factors affecting these, how these can be improved or maintained, and linkages to ecosystem health. The use of such an approach may clarify impacts from a change in fisheries management on poor people's livelihoods, and their ability to deal with such a change. For example, if applying the ecosystem approach means more conservative levels of fishing, what alternative income sources exist, and how plausible are these options?

In this approach, "a livelihood comprises the capabilities, assets and activities required for a means of living" (FAO/DFID, 2000, p. 2). In brief, the sustainable livelihood framework consists of five elements:

- People's livelihoods depend upon assets. These can be natural (e.g. fisheries resources), financial (e.g. cash or credit), physical (e.g. fishing gear), human (knowledge of where to find fish and how to catch it), and social capital assets (e.g. traditional management mechanisms, co-operative arrangements).
- The transforming structures and processes influencing the access people have to the different assets. Examples of these are the institutions, policies and regulations which influence the livelihood approaches people adopt and how they make use of their livelihood opportunities.
- The livelihood strategies are the options and the combination of options people have and adopt in order to make a living. For example, a community may rely on combining fishing for parts of the year with agriculture for the rest of the year in order to have an income throughout the whole year.
- Livelihood outcomes are the result of the strategies people adopted.
- The vulnerability context is made up of the factors (e.g. floods and droughts in inland fisheries) in the external environment which may affect the success of people's livelihood strategies.

People seek desired livelihood outcomes, such as an increased income, by exploiting available assets through various livelihood strategies. However, poor people are generally vulnerable to external impacts (e.g. natural disasters), trends (e.g. resource depletion, population change), and seasonal change (e.g. food availability and prices) hence their desired livelihood outcomes may not always be attainable, and these may also fluctuate. A sustainable livelihood would enable poor people to become more resistant or at least resilient to changes, trends and external shocks, so that they can maintain or enhance their assets and capabilities. The SLA is valuable in assessing the likely impact of potential or actual interventions, and may therefore be useful in moves towards an ecosystem approach.

Sources: Glavovic, 2006; FAO/DFID, 2000

fisheries following their needs. On the other hand, a commonly-advocated element of applying the ecosystem approach is to restrict access to the resource, e.g. through limited rights systems (FAO, 2005b). The latter move can produce significant impacts on the poor, if people are excluded when limited access is introduced. Alternatively, fishermen may migrate to other areas where they can access, and fish from, the same stock, thereby maintaining livelihoods but failing to limit resource exploitation). And furthermore, since small-scale fisheries take place along thousands of kilometres of coasts where enforcement and surveillance costs are high (Berkes *et al*., 2001; Castilla and Defeo, 2001, in Defeo and Castilla, 2005), how feasible is it to move to limited

BOX 4
Poverty mapping

Poverty mapping is a tool used by various organizations such as IUCN, the World Resources Institute, the World Bank and FAO. It can be used to identify areas globally where there might be specific problems in applying the EAF due to high levels of poverty, but at the same time indicating important social and conservation reasons for implementing the EAF. Such areas will therefore be high priorities for external support, unique and practical local solutions, or both.

One example is the IUCN Poverty-Conservation Mapping. Poverty in combination with high population density, in areas of high levels of biodiversity, is of particular concern as these areas are of great value in themselves, but are also exposed to high pressure from the people who may want to exploit the resources as a source of livelihood. As high level of poverty often suggest that employment opportunities are few, and the ones that do exist are thus very important, a measure of reduction in fishing effort may therefore be difficult to implement without some kind of community aid in the shape of alternative employment creation etc. In such cases, models can be developed to help predict causal relationship between socio-economic variables (e.g. poverty) and environmental change (e.g. biodiversity loss, decreasing fish stocks, damaged reefs). For example, the World Resources Institute (WRI) has used a mapping system to make an assessment of the health of many ecosystems' goods and services globally. In combination with poverty data, ecosystems in need of "pro-poor ecosystem management" can be found. Another related use could be that of linking biological resources data with that of poverty and nutrition, thus finding potential biological resources-food security relationships. These maps may in that way constitute an aid in identifying where poor people largely depend on biodiversity assets, and where they will benefit from ecosystem management.

This type of mapping is an analytical tool which can provide inputs in examination of poverty issues, for example in a sustainable livelihood approach. However, it should be remembered that although this tool is useful for exploring spatial relationships (visual correlations) between indicators, the maps do not in themselves show causal relationships. Thus, there is a risk of misinterpretation.

Sources: IUCN, 2004; FAO, 2003c.

access? The dilemma, then, is how to devise an effective, equitable way to implement EAF management in such fisheries.

Below follows an example of a tool for identifying areas in which there may be a high correlation between poverty and resource depletion. Related tools for information acquisition and management are provided in the Annex to this report.

FOOD SECURITY

Since 1973, the consumption of fish as food has doubled globally, and the developing world has been responsible for over 90 percent of this growth, largely from small-scale fisheries. Small-scale fisheries contribute fifty percent of all food-fish, and almost all fish from small-scale fisheries is used for food. Fish form a crucial part of the diet of millions of the world's poor (FAO, 2005b). Indeed, in 2001, more than 400 million people received more than 50 percent of their protein from fisheries (FAO, 2005c).

There are two ways in which fishing can contribute to food security – *directly* through the supply of fish itself (i.e. self-consumption), and *indirectly* through revenues generated from production and related processing and marketing activities, depending on whether individuals are self-employed or paid wages, which can then be used to

purchase food (FAO, 2005b). At a national level, direct domestic consumption of fish can be encouraged (e.g. self-sufficiency of fishing communities) and/or exports of high value fish species can enable imports of low value fish species and other food types.

Various possible impacts of EAF on food security could occur. For example, if EAF leads to decreases in available fish landings (whether only short term or both short- and long-term), the result is less access to food/protein (even if only temporarily) for a certain fraction of those who rely on fish as a key protein and food source. On the other hand, if applying the EAF would lead to greater abundance of higher value species, this could possibly lead to increased export revenues. These revenues could thus lead to increased opportunities of purchasing low value fish species and other food types, hence increasing food security.

CULTURAL AND RELIGIOUS CONSIDERATIONS

Another social consideration when applying the ecosystem approach to fisheries is how the religious practices or cultures of certain fishing communities may be affected, or may bear on EAF implementation. Fishing activities often have a cultural or religious value and these may contribute to, or perhaps hinder, the adoption of an ecosystem approach. At the very least, such aspects must be *understood* in order to facilitate a change in management approach.

Traditional beliefs regarding fisheries have developed through processes of association and interpretation of natural phenomena, and they often play an essential role in deciding how people use fisheries resources, or at least in justifying and explaining resource use. Therefore it is vital to have some understanding of existing beliefs and customs regarding fisheries resources when presenting ideas for management, as these will provide key information on what may be acceptable to the local community (FAO, 1998).

The religious structure of the community may have important implications for the way in which fisheries resources are exploited – both in the fishing activity and the consumption of fish products. For example, religious proscriptions which forbid the consumption of shellfish, molluscs or particular types of fish may mean that fishing effort is concentrated on other species, hence increasing the chances of depletion of those stocks. Local beliefs and customs may also impose other limits on fishing activities or on participation in fisheries (FAO, 1998).

The practice of a particular fishery may be at the centre of people's beliefs and customs, and the use of a particular gear may be based on traditions and beliefs, resource knowledge or skills which often have been passed from generation to generation. In such cases, people's attachment to the fishery on which they depend often goes beyond the economic benefits derived from it. An example of this is salmon fishing by native Americans and Canadians on the west coast of North America, where the importance of the fishery for indigenous cultural values has been recognized in current efforts to manage the fishery (FAO, 1998).

Attempts to alter patterns of fisheries which form an important part of local cultures may be resisted if they are interpreted as a threat to the social and cultural independence and distinctiveness of a community. Thus, the success or failure of management measures will often ultimately depend on the extent to which those affected by them understand their function. However, scientists' understanding of fisheries resource issues and artisanal fishers' understanding will often differ quite radically. Therefore it is important to seek out common ground and find ways in which "scientific" management measures may translate into a locally appropriate form (FAO, 1998).

For example, in an attempt to establish a way to harvest mussels sustainably for subsistence needs, in an area on the east coast of South Africa, harvesters participated in an experiment which was designed to visually demonstrate appropriate harvest levels. This was done by allowing different levels of harvesting intensities in different

sub-zones, which then clearly showed how intense harvesting could lead to over-exploitation. In order to ensure an understanding of the activity, role-playing was used both before and during the experiment. Results from the experiment were also presented at joint committee workshops by using images, models and clearly intelligible graphs, as well as translating the findings into Zulu. It was noted that although traditional knowledge played a valuable role in the project, it was said to be limited to observable phenomena. It was therefore felt that providing harvesters with scientific information would help them better understand the resource and participate in management decisions (Harris *et al.,* 2003).

Some further factors may provide guidance on the level of adaptability, and underlying attitudes, towards management measures such as the ecosystem approach:

- Skills and knowledge regarding fishing techniques and fisheries resources will often be passed from one generation to the next at the household level. The extent to which this takes place, and the patterns of inheritance of occupational skills, will inform on how an understanding of management issues will be passed from generation to generation.
- Where fisheries resources are in decline, or access to fisheries is threatened, it can be important to provide opportunities for youth to have the education needed to shift to non-fishery activities more easily. This of course also depends on the *availability* of schools and/or the *opportunities* a household has to send its children to school, as well as traditional/cultural/religious *attitudes* towards education, particularly of girls/women.
- As people's attitudes towards authority will play a great role in shaping their responses to efforts to manage their fishing activity, this would mean that if a particular institution is perceived by fishers as being either not trustworthy or dominated by particular sets of interests which are not necessarily sympathetic to the needs of fishers, co-operation is likely to be hindered (FAO, 1998).
- In terms of introducing changes to the customs of a society, it should be remembered that the culture of a society is not an accidental collection of customs and habits, but rather something that has been evolved by the people to help them in their conduct of life. There is a definite purpose and function behind each aspect of the culture of a society. Social structures, in general, need to be understood in order to gain appreciation of who does what in a community, who makes decisions, and who (from within the community or from outside) may influence the community to accept change. Such structures may be based on sex, religious and ceremonial groups, age, kinship/kinship groups, grouping on the basis of common residence, etc. If there is a reluctance to change within the community from the beginning, unforeseen difficulties in attempts to achieve EAF management may cause further reluctance to change.

In Box 5, an example is given of a theoretical framework which can inform the implementation of EAF management, by highlighting cultural and religious factors in a local/traditional community context.

INDIGENOUS PEOPLE AND TRADITIONAL KNOWLEDGE

In addition to the role that cultural or religious practices may play in the application of an ecosystem approach to fisheries, the knowledge held in local communities and by indigenous peoples is also important. Mechanisms to use this appropriately need to be developed.

It is well-known that many indigenous people or local communities have a profound empirical knowledge of the environment in which they live, one central reason being the fact that their survival may depend on their understanding of how different patterns of resource use will affect the sustainability of resources in the future. Their understanding of the environment is often close to the conceptual basis for integrated

BOX 5

The interdependency hypothesis and local communities/indigenous people

The *interdependency hypothesis* suggests that ecosystem viability and community viability are interconnected. Its theoretical framework consists of three dimensions: *ecosystem viability, community viability, and external forces*. It is suggested that ecosystem viability and community survival are two interdependent objectives that should be given equal focus if both are to benefit, and stresses the need to consider the extensive knowledge of local communities about local ecosystems. Although this framework is created for application to conservation projects, the relevance to an EAF can be found in its highlighting of the local/traditional community context and which factors may need special attention when shifting towards more sustainable fishing practices. The proposed theoretical framework consists of a series of factors important for ecosystem conservation and community viability and can provide a general guide during the design, monitoring, and evaluation phases of projects. These general factors should be considered in the light of the specific human culture and natural ecosystem considered.

The three dimensions that form the basis of the theoretical framework are ecosystem viability, community viability and external forces. Given the focus on human dimensions in this report, the latter two of these are discussed below.

Community viability. The community viability dimension consists of four main categories – culture, well-being, participation, and knowledge – each of which consists of a series of factors that are assumed to contribute to the viability of local communities.

a) Culture – consists of *cultural sustainability* and *social and environmental values*. As many projects try to provide local people with alternative sources of income, insufficient attention is often given to the cultural importance of the original source of income. Certain practices, such as tree harvesting and hunting, are not solely performed for the sake of the economic income, but have important social, cultural and religious values too. Because there are cultural and spiritual reasons why local people engage in these practices, providing them with alternative sources of income is often a simplistic and unsuccessful strategy in alleviating problems such as over-harvesting.
b) Well-being – consists of *economic well-being* and *physiological and psychological well-being*. Even if communities are not poor, economic well-being may be essential in ensuring the viability of those communities. For example, reduced employment opportunities, due to more conservative fishing, may lead to migration of young people to urban areas, thus leaving villages populated with older residents and no mechanism for community viability. In addition, when such fundamental needs as health and security are missing, community cohesion and survival are threatened and long-term conservation goals (e.g. sustainable fishing practices) may seem less important.
c) Participation – includes the factors *community participation* and *community capacity*. Through participating in the process that would impact their lives, local people can have the opportunity to choose activities (practices) that do not compromise the integrity of their culture and the viability of their community.
d) Knowledge – consists of the factors *environmental knowledge* and *cultural knowledge*.

Traditional environmental or ecological knowledge is being passed on from one generation to another. This knowledge may be useful in finding the most appropriate way of applying the ecosystem approach in a certain cultural/traditional setting, possibly basing it on such traditional knowledge.

External forces. As local communities and the associated natural ecosystems constitute a part of a larger social, economic, and political context, they are inevitably subject to influences originating from outside of their locality. An external environment may on the one hand support and enable local

communities and natural areas to thrive, and on the other hand it might instead threaten the ecosystem and community viability. This component describes what form external social, economic and political forces may take. Such forces need to be acknowledged, and preferably addressed, in order to enhance ecosystem and community viability.

a) Social forces – can work in two extreme ways: (i) policies promoting the conversion of natural areas to commodity goods may be favoured by a public that seek fast economic growth at the expense of nature conservation, or (ii) people may be willing to sacrifice the sustainability of local communities and their culture for nature conservation. Thus the social values of the public can provide an indicator for predicting whether certain projects will have the support of the society at large.
b) Economic forces – Financial incentives often contribute to the destruction of natural ecosystems.
c) Political forces – It has been suggested that national and international laws and policies are the most powerful external factors that impact ecosystem- and community viability. This type of force can be, for example, national land policies which encourage migration to remote areas and the clearing of forests in exchange for land, but also international policies, such as trade liberalization and structural adjustment.

Source: Michaelidou *et al.,* 2002

or holistic management. A gender aspect of this local knowledge is that women often exploit resources and ecological niches which men may have little or no knowledge of. This special knowledge, and women's skills in exploiting it, may provide important input into fisheries management decision-making (FAO, 1998).

It has also been suggested that conservation measures can support the recognition and guarantee of the rights of indigenous people (IUCN/WWF, 1999). One can find similarities between aspects of the ecosystem approach and the approaches of many indigenous and other traditional peoples' organizations (Berkes, 1999) - for example, with respect to protected areas within their territory. The concept of sustainable use of resources is most often an inherent part of the traditional/indigenous way of thinking as they feel connected to the land/water, as a home to their ancestors but also to their children, suggesting that certain restrictions to the use of the resource may be acceptable as it would benefit future generations (Borrini-Feyerabend *et al*., 2004).

Some of the ingredients considered important in this regard are:

- that their rights to the territory, and their rights to control and co-manage the resources and determine their own development priorities, are recognized;
- participation of traditional institutions in co-management arrangements is allowed;
- prior informed consent; and
- sustainable use of natural resources that have been used traditionally by indigenous people is incorporated in the management plan whilst maintaining the integrity of the ecosystem (IUCN/WWF, 1999).

In applying the ecosystem approach and reducing fishing pressure where needed, traditional knowledge can often provide suitable management options. For example, there may be rights-based fisheries in place, often based on rotational access to fisheries resources – although this system is more easily applied to non-mobile gear and species and often focuses on mitigating conflicts between user groups over access rather than reducing overfishing pressures (Mathew, 2003).

Box 6 describes an example of a local community's effort to adopt the ecosystem approach to fisheries.

BOX 6

Example of an ecosystem approach initiative in Bocas del Toro, Panama.

Bocas del Toro is a marine archipelago off the coast of Panama with diverse mangrove forests, a unique flora and fauna, and coral reefs. A rise in tourism has led to unplanned development in the area, putting great pressure on the ecosystems because of over-fishing of the lagoons and coral reef destruction. The local communities have always sustainably used and depended on the goods and services provided by the ecosystems, hence by their own initiative, indigenous fishermen have now suggested regulation of the access to fishing grounds and area protection to the government, as means towards more sustainable use of the resources. These suggestions are supported by, amongst others, the IUCN Commission on Ecosystem Management, and a community management plan for the whole archipelago has been developed, based on the ecosystem approach, together with local authorities and NGOs. This plan includes a national park, seven community areas with areas for conservation but also for sustainable use, and also a buffer zone with regulated access and use. However, these areas are controlled by the authorities and as the communities have not yet received a response from these, they are not sure how to proceed without legal confirmation of their plans.

Source: Windevoxhel, 2006

DISTRIBUTIONAL ASPECTS

A crucial matter to consider in any management action, and particularly in the implementation of as profound a shift as the introduction of EAF management, is that of the distributional impacts of the changes. Four issues that need to be considered are as follows:

1. **To whom do the various benefits and costs accrue?**
   A major consideration in EAF implementation, as noted in the EAF Guidelines, is the question of who receives the benefits and who incurs the costs of that implementation. This question arises in terms of the cross-section of current participants in the fishery (and beyond) as well as over time (see below).
2. **Intertemporal aspects: When do the various benefits and costs occur?**
   The potential benefits and costs of EAF management, if they occur at all, may do so over a wide range of time scales in the evolution of the fishery. For example, some potential benefits may be realized over a longer time frame (e.g. larger fish stocks), while some costs (e.g. of more elaborate management) are potentially arising in the short term. There may be certain realities (e.g. annual food supply considerations, electoral time frames) that also affect or constrain implementation of EAF.
3. **Scale: At what scale do benefits and costs occur?**
   Similarly, the potential benefits and costs of EAF may occur over a wide range of spatial/geographical or administrative scales (e.g. local, national, international). There may, for example, be a benefit that is international in scale (e.g. increased existence value of conserved biodiversity) and a corresponding cost that is local in scale (such as a negative impact on displaced fishers in a specific fishing community near an MPA), or any other combination could arise. Even within a given fishery ecosystem, the migration of fish and/or larvae may lead to situations in which those incurring the costs of conserving resources or habitats may not be those receiving the benefits (or at least may be sharing the benefits with others who are not incurring costs).

4. **Form of the benefits: What is the distribution of benefits across the various types?**
   The various benefits and costs of EAF implementation reflect the range of human values of fisheries ecosystems, as discussed in Chapter 2. Therefore it is important to recognise that the benefits could arise in any of the following forms:
   Use values:
   - net economic benefits of fishing, including income and employment
   - food provision and food security benefits
   - non-fishing use values that arise from fisheries ecosystems, e.g. tourism, aquaculture
   - the values of fisheries ecosystems as mechanisms for social interaction and as local "commons", as well as providers of livelihoods

   Non-use and existence values:
   - cultural benefits of fisheries ecosystems (e.g. for artistic expression or ceremonies)
   - aesthetic and existence benefits (e.g. the value of watching a sunset by the sea, or of knowing that whales are swimming in the sea)
   - option value (i.e., the value of maintaining fisheries ecosystems in terms of possible future benefits that might be realized as a result)

CONCLUSIONS

This chapter has explored a wide range of social and economic considerations that can influence the form and extent of EAF implementation. Specifically, the following have been discussed: (a) employment, livelihood and regional effects, (b) impacts on poverty levels, (c) impacts on food security, (d) cultural factors that may affect EAF implementation, (e) use of traditional knowledge and management practices, and (f) impacts on the distribution of benefits and costs related to EAF implementation. This list of themes can be viewed as a form of checklist to consider in moving to an EAF management framework. However, it must be noted that (i) since only brief overviews of each topic have been provided here, in practical EAF implementation, more in-depth understanding of each topic will be required, and (ii) no claim is made here to the completeness of this list of topics, as fisheries have within them a very wide range of social, economic and cultural considerations. Nevertheless, the material presented in this chapter represents a starting point in incorporating relevant factors in the move to EAF management.

PART II

FACILITATING THE IMPLEMENTATION OF THE EAF

5. Initial steps in implementing the EAF

Moves to EAF management can take many forms – from small steps to introduce ecosystem considerations into conventional management, through to major efforts to re-design fisheries management institutions, regulations, and processes. Decisions concerning the extent of EAF implementation will need to take into account factors such as the feasibility of the time frames involved, the budgets and human resources available, the administrative and political realities of the situation, among other considerations.

BOUNDARIES, SCALE AND SCOPE

The EAF, and indeed any form of fisheries management, faces an initial challenge of defining the relevant "fish stock" to manage, i.e. setting the right boundaries, as well as deciding on the appropriate scale and scope within which to manage. Often, as time passes, these matters are seen as resolved – fisheries management proceeds and such issues are no longer the subject of debate. However, moves to an EAF re-open the discussion, since dealing with ecosystems and "fishery systems" leads to questions of ecosystem boundaries (as opposed to fish stock boundaries) as well as potentially enlarging the spatial scale of management (e.g. to better incorporate certain ecosystems) and adjusting the scope of management (e.g. to include human impacts on ecosystems that have not been traditionally managed). These matters are explored briefly here.

Boundaries

To study or manage any system – whether it be an ecosystem, a coastal zone or an economy – requires specifying its boundaries. There is a continual challenge of determining appropriate boundaries around any given ecosystem, or in determining suitable boundaries specifying who are to be included as human participants in "the fishery". The challenge is compounded in meshing together ecosystem boundaries with social, economic and institutional boundaries. Specifically, management units might be defined to reflect biological stock units and oceanographic realities, or on the basis of human factors (to reflect, for example, the cohesive nature of a fishing community, or jurisdictional lines).

Can boundaries simultaneously reflect ecological, economic, socio-cultural, institutional and political considerations? If not, is one way of defining boundaries intrinsically better than another, or how do we balance the "natural" delimitations of watersheds, coastal zones, etc., on the one hand, and the boundaries of the system from the perspective of human populations and activities, on the other? What factors are of greatest importance in setting boundaries?

An example of these challenges has arisen in EAF implementation efforts in the Benguela region of southern Africa. These efforts have recognized the importance for management of taking into account the boundaries reflecting the two primary ecosystems of Angola, Namibia and South Africa, i.e. (1) the Benguela upwelling system in the central and southern part of the region and (2) the warmer ecosystem north of the Angola Front which typically occurs in southern Angola. However, such boundaries cross national jurisdictions of coastal states, thereby requiring cooperative linkages among nations in the region.

Scale

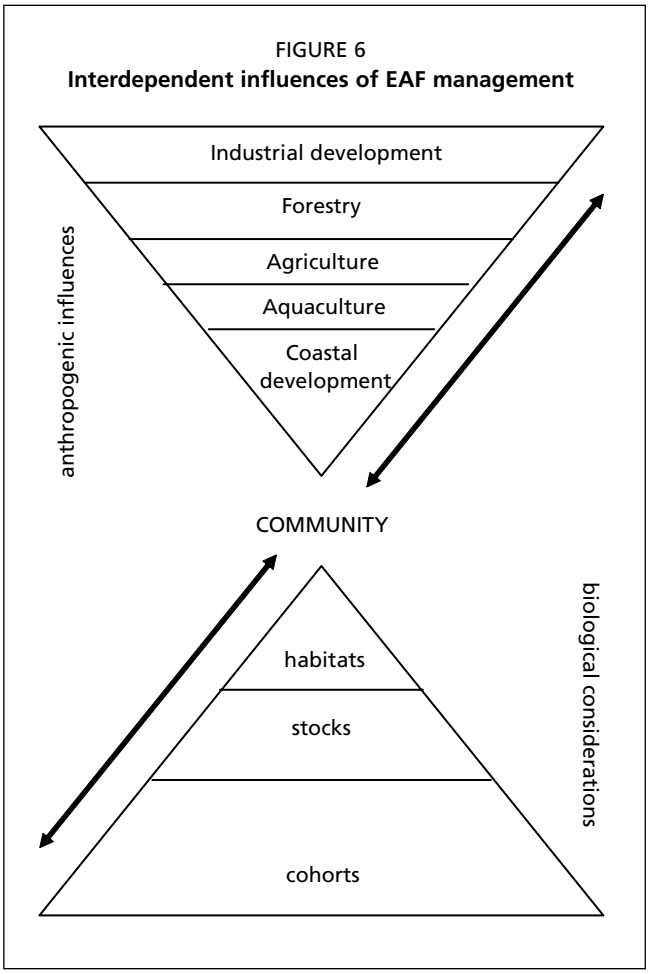
The scale of a fishery system can vary greatly. On the one hand, a discrete small-scale fishery may be based in a small bay or lake, with its local fish resources and a corresponding fishing community. On the other hand, there are fisheries at the scale of a province/state or a nation, or those on an even larger scale of regional multinational fishery organizations such as the European Union or the FAO's regional fishery management organizations. The question of scale arises in three ways regarding the EAF:

First, it is important to understand whether the many social, economic and institutional considerations in implementing the EAF vary depending on the scale of the fishery (e.g. local, national, regional, or even broader, scale), and in what manner.

Second, in implementing the EAF it will be important to address the challenges in managing fisheries in which (a) human (social, economic and institutional) scales are different from that of the resource, or that of the harvesting activity, or (b) there can be differences in the scales that are appropriate to deal with each component of a fishery – fish stocks, fishers, science, enforcement, policy, etc.

Third, management of a given fishery may be required at multiple scales, and this may involve a process of "scaling up" or "scaling down". For example, if fisheries management (and an EAF) is already implemented at a broad geographical scale (e.g. state, province or nation), this may need to be scaled to work at a local level. Equivalently, when local-level or community-based management is in place within local ecosystems, this may need to be "scaled up" while allowing for spatial heterogeneity and differing human and institutional arrangements. These situations may imply a need for "cross-scale linkages". For example, if local or decentralized approaches to management are needed to account for local conditions, but the fish stocks range over larger geographical areas, an institutional arrangement may be needed to help coordinate across boundaries. This could be the case for a fishery on a highly migratory stock, such as tuna. In that case, biological aspects are on a large scale, crossing national boundaries, while a national or sub-national scale may fit for the fishers and the management system, and indeed very local management of fleets may also be effective.

FIGURE 6
Interdependent influences of EAF management



Scope

The scope of the fishery system is also crucial to determine. What is included or excluded? An EAF broadens the scope beyond seeing a fishery as simply "fish in the sea, people in boats", beyond consideration only of commercially-important species, beyond management efforts directed solely at the harvesting process. In other words, it becomes important to include interactions between the core of the fishery – fish and fishers – and other elements of the ecosystem and the human system relevant to management (Figure 6). To neglect such interactions

(whether these be predator-prey or harvesting-processing or some other interaction) may lead to unexpected negative results from management measures.

The key lies in seeking a suitable balance – to incorporate a suitably broad perspective into fisheries management, but doing so without incurring excessive costs or over-extending the management activities by attempting to manage too much. For any given fishery, the idea is to determine what components of the broad fishery system (which non-target species, which post-harvest activities, which community institutions, etc.) need to be incorporated to make EAF management effective.

CONCLUSIONS

This brief chapter has focused on three key matters that must be settled prior to undertaking EAF implementation, namely determination of the boundaries, the scale and the scope within which the EAF is being considered. As alluded to at the start of the chapter, decisions about the extent of EAF implementation will also need to take into account additional factors such as the feasibility of the time frames involved, the budgets and human resources available, the administrative and political realities of the situation, etc. The reality behind all of these considerations is the fact that EAF management can take many forms, from an incremental move to account for ecosystem interactions within largely conventional management, through to the re-designing of fisheries management institutions, regulations, and processes in the spirit of a full ecosystem approach. Accordingly, choices exist among multiple paths towards EAF management, and therefore, as is often said when dealing with complex systems such as fisheries, one size does not fit all.

6. Assessing the impacts of EAF management

BENEFITS AND COSTS OF EAF

As discussed earlier, the ecosystem approach to fisheries (EAF) has the potential to produce a variety of benefits, both general (e.g. ecosystem health, sustainable natural resource use) and more specific, notably those relating to human considerations (such as greater employment and income generation, aesthetic benefits). On the other hand, potential costs of implementing EAF include direct costs of implementation (e.g. increased management costs) and indirect or induced costs (e.g. the risk of reduced employment and/or revenues in the short term). To assess the consequences of moving to EAF management, it is necessary to (1) determine what are the relevant benefits and costs, and then (2) measure each of these and draw conclusions from comparing the benefits and costs.

Consider the first of these steps. While this can only be carried out fully given the details of a specific fishery, it is possible to consider in general the various possible benefits and costs that might arise from EAF management. Table 1 lists some of these benefits and costs, grouped under the four headings: ecological, management, economic and social.

Two points must be noted here. First, this is simply a generic listing of possibilities, with no claim to being exhaustive. Second, the categories used here are intuitively sensible, but are not those typically used in formal cost-benefit analysis or social impact assessment (methods that are discussed below). For example, in cost-benefit analysis, economists view "economic" costs and benefits as all those of a societal or "global" nature (thus including most ecological and social aspects) while "financial" costs and benefits are monetary aspects as seen from a private perspective.

For some entries in Table 1, an indication is given of the conditions or particular situations that may produce the benefit or cost in question, but ultimately the potential magnitude of the benefit or cost, and its probability of occurrence, will depend on

TABLE 1
Some possible benefits and costs of EAF implementation

Ecological benefits and costs

Benefits	Costs
Healthier ecosystems (directly or with EAF linkages to effective ICOM)	Decreased fish stocks (if fishery management is now less effective than previously)
Increased global production of goods and services from aquatic ecosystems (a global benefit)	Increased habitat damage (if management is now less effective or creates induced impacts)
Improved fish stock abundance (due to healthier ecosystems)	Shift in fishing effort to unprotected areas, leading to a loss of genetic biodiversity
Reduced impact on threatened/endangered species	Greater highgrading/dumping, and thus more wastage (if catch and/or bycatch is restricted)
Reduced bycatch of turtles, marine mammals, etc.	
Less habitat damage (due to more attention to fishing impacts)	Reduced fish catches (if more predators – e.g. seabirds, seals – due to better protection
Lower risk of stock or ecosystem collapse	
Reduced contribution of fisheries to climate change (if EAF leads to lower fuel usage)	
Improved understanding of aquatic systems	

TABLE 1 (cont.)

Management benefits and costs

Benefits	Costs
Better integration in management across fisheries, other uses, etc.	Increased cost of management
Clearer expression of management objectives, leading to greater societal benefits	Increased cost of research
Better balancing of multiple objectives	Increased cost of data collection and data management
Better balancing of multiple uses, leading to increased net benefits	Increased cost of coordination across fisheries & aquatic uses
More robust management due to broadening from single-species tools	Increased cost of additional and more participatory meetings
Improved compliance due to more "buy-in" to management, through better participation	Increased cost of monitoring, observers, etc.
	Increased risk of non-compliance (if regulations too complex or unacceptable)
	Increased risk of collapse of management system (if too demanding of resources)
	Risk of management failure (if excessive faith placed in "new" EAF paradigm)
	Poor management results and loss of support (if EAF imposed or implemented improperly)

Economic benefits and costs

Benefits	Costs
Increase in benefits to fishers per fish caught (bigger fish from a healthier ecosystem)	Reduced catches (especially in short term)
Increased catches (especially in long term)	Loss of income to negatively affected fishers
Increased contribution to the economy (especially long term)	Increased income disparity among fishers (if EAF impacts are uneven)
Reduced fishing costs (if EAF results in reduced bycatch)	Reduction of government revenues from licenses, etc. (if there is reduced effort)
Increased net economic returns (if EAF involves reduced fishing effort, towards MEY)	Reduction in benefits to fishers (if lower government support)
Higher-value fishery (if increased availability of food to top predators increases stock sizes)	Reduced contribution to economy (short term)
Greater livelihood opportunities for fishers (e.g. in tourism, if charismatic species abundances increase through EAF)	Reduced employment in short term and possibly long term
Increased non-use (e.g. cultural) and existence values (the latter resulting from appreciation of healthier aquatic systems and a greater abundance of aquatic life, etc.)	

Social benefits and costs

Benefits	Costs
Positive impacts on food supply in long term (if greater catches become possible)	Negative impacts on food supply in short term (and risk of this also in long term)
Synergistic positive effect of coordinated EAF across fisheries and/or nations (LME)	Greater inequity (if EAF favours those able to invest in appropriate technology)
Greater resilience (if there is emphasis on multiple sources of fishery livelihoods)	Greater inequity (if there is mis-placed allocation of responsibility for EAF costs)
Greater resilience (if increased bycatch results in more livelihood opportunities)	Increased poverty among those adversely affected by EAF (short term, or both)
Reduced conflict (if EAF processes deal effectively with interfishery issues)	Reduced benefits to fishers (if EAF linked to ICOM, and tradeoffs detrimental to fishers)
	Greater conflict (if EAF leads to enforced interaction among a larger set of societal and/or economic players)

the specifics of the fishery and of EAF implementation. Note that in the case of a cost of EAF, for a given fishery, the product of the probability of occurrence and the magnitude of the cost represents the "risk" associated with that cost.

While the above listing of possible benefits and costs of implementing EAF was organized according to ecological, management, economic and social categories, another route to viewing benefits and costs is by organizing them according to specific stages and actions involved in implementing the EAF. Through a step-by-step examination of FAO's EAF Guidelines, a set of five tables has been created, listing EAF considerations that have implied benefits and/or costs on the following themes:

1. Moving towards EAF management (from Guidelines section 1.4)
2. Options to manage fishing (from Guidelines section 3.2)
3. Legal and institutional aspects of EAF (from Guidelines section 4.2)
4. Research for an improved EAF (from Guidelines section 5)
5. Threats to implementing EAF (from Guidelines section 6)

The tables are contained in Appendix 6.1 to this chapter. Note that each of these represents a template to be completed in a specific fishery/ecosystem situation – i.e., each includes a set of elements arising in EAF implementation, for each of which it is necessary to determine (a) whether the element is applicable in the particular fishery or ecosystem under discussion, and (b) if so, what are the relevant benefits and costs arising for that element (measured qualitatively or quantitatively).

MEASURING BENEFITS AND COSTS

A wide variety of potential benefits and costs of EAF were listed above, but how each of these is actually measured in practice is another matter, as is the subsequent decision-making challenge of comparing among the various benefits and costs in order to come to appropriate conclusions. We consider here the feasibility of measuring the benefits and costs described in Table 1 that deal with management, economic and social aspects.

Among *Management benefits and costs*, several of the costs (e.g. for management, research, data handling, additional meetings, monitoring and observers) are readily assessed from governmental sources of information, possibly supplemented by suitable surveys. Other costs (e.g. the risks of non-compliance or of collapse of the management system) are difficult to measure objectively, but may be amenable either to modelling or to surveys and interviewing. Most of the benefits listed (e.g. better integration in management across fisheries, clearer expression of management objectives, better balancing of multiple objectives and of multiple uses, etc.) are difficult to assess objectively, although some (e.g. improved compliance through better participation) can be assessed based on available data (e.g. infractions reports).

Economic benefits and costs are generally easier to measure. First, some are amenable to standard fishery data gathering – e.g. for benefits or costs at the fisher level (such as changes in income per fish caught, in catch levels, and in fishing costs), and for those at the sector level (such as changes in employment, net economic returns, and contribution to the economy). Some measures can be obtained through governmental accounting systems (such as changes in the revenues from licenses, etc.). Still others may require more specific data collection, e.g. through surveys to assess changes in livelihood opportunities for fishers, or in increased income disparity among fishers.

The *Social benefits and costs* noted above are generally much more challenging to assess. This is certainly the case, for example, with changes in management efficiency and overall resilience of the human system. However, effects on the food supply, on poverty levels, on levels of inequity and on conflict all have objective methods for measurement. Thus there is likely to be a wide variation in the capability to measure social benefits and costs.

A wide range of methodologies could be used in measuring the social, economic, and management benefits and costs of EAF implementation. These come from a wide range of disciplinary traditions and approaches, and many are similar to those listed in Chapter 2 for valuation of aquatic ecosystem services. Some possibilities are as follows:

- direct fisheries measures
- direct governmental accounting
- socio-economic surveys
- cost-benefit analysis
- social impact assessment
- indicator frameworks
- contingent valuation and travel cost methods
- attitudinal and stated preference surveys
- bioeconomic models
- structured or semi-structured interviews
- asset mapping
- national systems of accounts

The choice among these methods will vary from case to case. Note that those methodologies of a particularly broad nature such as bioeconomic models, national systems of accounts and indicator frameworks (as described in Chapter 2) have the potential to provide cross-cutting approaches to assessing and monitoring the management, economic and social aspects in Table 1. A more detailed look at some of the major methodologies is presented in the following section.

DECISION-MAKING TOOLS FOR ASSESSING EAF

There are various analytical frameworks available to assist in the decision-making process relating to EAF implementation. This section considers a sampling of decision-making tools, such as cost-benefit analysis, social impact assessment, indicator frameworks, socio-economic monitoring, systems of national accounts, simulation and bio-economic models. Each of the tools is discussed in sequence below, and in most cases, sources for further information are provided. Furthermore, a set of additional decision-making tools is presented in Appendix 6.2; with some adjustment in their application, these may be relevant for EAF as well.

Goal ranking

Goal ranking is designed to make goals and expectations explicit, and to assist in discussing them with others, often as a means to collectively reach agreement on priorities. Without a systematic method of prioritization it may be difficult to preferentially and efficiently allocate attention or resources to the goals that stakeholders deem most important. A goal ranking exercise can address this situation. Goal ranking can be used in the early steps of the policy and planning processes in EAF when several competing or perhaps conflicting goals have been identified. Ranking by voting or other numerical processes can be supplemented with negotiation to arrive at consensus goals. It is also possible to use the ranking for assigning weights to goals in order to assist selection.

Problem trees

The problem tree is an analytical tool, usually done as part of a participatory planning process, to logically and visually identify the root causes of observed problems by linking and hierarchically clustering a series of problems. It can complement several other tools, and forms an important part of the planning toolkit, particularly in Rapid or Participatory Rural Appraisals, where the visualization lends itself to use in the field with any stakeholder group. Problem trees are useful in planning EAF where

there are multiple problems, the relations between which are not easily discernible to stakeholders. Using the problem tree method shows participants that their problems are being taken seriously. Relating problems to each other is a useful means of emphasizing the shared ownership of agreed upon issues.

Cost-benefit analysis

The most common and, in theory, complete decision-making tool used to determine the economic efficiency of choice sets faced by decision-makers is cost-benefit analysis (CBA). CBA, or economic efficiency analyses, form one instrument for evaluating potential projects. The streams of future costs and benefits are estimated, summed, and placed into their "current" year value, entitled the net present value (NPV = the stream of benefits minus the stream of costs, discounted to reflect the future point in time in which the various benefits or costs are to occur). The NPV of the status quo alternative may be compared with the NPV of several alternative projects or scenarios; however, and commonly, an individual project NPV is calculated without bases for comparison. In the former, the alternative with the highest NPV would be the preferred choice; while in the latter use, projects with positive NPV would be accepted. Variant measures of economic efficiency include the ratio of benefits to costs or the estimated internal rate of return;[17] since these are non-denominational, this makes ranking across projects easier. Sumaila (2001) presents a brief overview of the CBA approach, a suggestion on how to deal with discounting benefits accrued by future generations, and an application of this adjusted CBA to a hypothetical case of marine ecosystem restoration.

As a complete CBA would estimate all benefits and costs related to management alternatives, it will be necessary to apply several of the valuation tools mentioned earlier in this chapter. Given the cost implications of a complete CBA, these tend to be partial analyses (especially with regard to benefits), which may at least provide lower bound estimates. When a management agency is faced with budget constraints, a pre- and non-monetary evaluation of potential costs and benefits and their relative priority ranking would assist the agency in appropriately allocating limited funds.

Social impact assessment

As described by TICPGSIA (2003), a social impact assessment (SIA) focuses on human environment issues and their resolution. It constitutes a tool in decision-making, aiding those affected and responsible agencies, in assessing the impacts and desirability of a proposed action. An SIA looks for social and cultural factors that need to be considered in a decision, and providing a mechanism for incorporating appropriate knowledge and values into the decision. In general, SIA assists in the identification of the most socially beneficial course of action. Some of the principles and related guidelines of SIA (see below) can be used in considering social implications of applying the EAF.

Indicator frameworks

Indicators frameworks constitute a useful guidance tool in the decision-making process in that they can "communicate ecosystem service benefits, and support.... the communication of spatial interdependencies to decision-makers and stakeholder groups" (Boyd *et al.*, 2004). Being used to enhance transparency, communication and effectiveness in natural resource management, indicators provide help in the assessment of the performance of fisheries policies and management at all levels. In relation to sustainable development goals, indicators can illustrate the trends and state of a specific resource, or the sustainability of fishery activity, or they can be analysed at a broader societal or ecosystem level (FAO, 1999b).

[17] To estimate the internal rate of return, the NPV is fixed at zero, and the discount rate is determined that makes the present value of flows of costs and benefits equal over the life-span of the project.

BOX 7

Social impact assessment

Some principles and related guidelines of SIA are as follows:

1. *Achieve extensive understanding of local and regional settings to be affected by the action or policy*
   - Identify and describe interested and affected stakeholders and other parties, and understand their interests and values (e.g. social groups affected by outcomes of an action, e.g. transition to EAF).
   - Develop baseline information (profiles) of local and regional communities (e.g. existing conditions and past trends associated with the relevant human environment).

2. *Focus on key elements of the human environment*
   - Identify the key social and cultural issues related to the action or policy from the community and stakeholder profiles (carried out with public involvement, producing a list of the most significant impacts in order of priority, and all significant impacts for all interested and affected parties).
   - Select social and cultural variables which measure and explain the issues identified (pointing to measurable change in human populations, communities, and social relationships).

3. *Identify research methods, assumptions and significance*
   - Research methods should be holistic in scope (describing all social impacts related to the action or policy, so decision-makers and the affected public are given the chance to evaluate them).
   - Research methods must describe cumulative social effects related to the action or policy (resulting from the incremental impacts of an action added to other past, present or foreseeable future impacts).
   - Ensure that methods and assumptions are transparent (and replicable)
   - Select forms and levels of data collection and analysis appropriate to the significance of the action or policy.

4. *Provide quality information for use in decision-making*
   - Collect qualitative and quantitative social, economic and cultural data sufficient to usefully describe and analyse all reasonable alternatives to the action.
   - Ensure that the data collection methods and forms of analysis are scientifically robust
   - Ensure the integrity of collected data

5. *Ensure that any environmental justice issues are fully described and analyzed*
   - Ensure that research methods, data, and analysis consider underrepresented and vulnerable stakeholders and populations.
   - Consider the distribution of all impacts (whether social, economic, air quality, noise, or potential health effects) to different social groups (including ethnic/racial and income groups) - identifying those whose adverse impacts might be lost in the aggregate of benefits.
   - Undertake evaluation/monitoring and mitigation
   - Establish mechanisms for evaluation and monitoring of the action, policy or program
   - Where mitigation of impacts may be required, provide a mechanism and plan for assuring effective mitigation takes place – such as avoiding the impact; reducing the impacts by redesigning the project or policy; or compensating for irreversible impacts (e.g. by providing alternative employment for fishers who may lose their job because of changes in fishery management).
   - Identify data gaps and plan for filling these data needs.

Source: adapted from TICPGSIA (2003)

BOX 8

An example of the use of social impact assessment within fisheries.

The Tortugas Ecological Reserve was created in the Florida Keys (United States of America) as the result of a 3-year collaborative process called "Tortugas 2000" to deal with problems such as a degrading marine environment, and commercial and recreational fishing pressure that had reduced the average size of some fish species. This reserve is a "no-take" area, created to protect the critical coral reef ecosystem of the Tortugas, thus preserving species diversity and health of fish stocks, to help ensure the stability of commercial and recreational fisheries, and to provide opportunities for education and research. As a part of the collaborative process, and to develop a preferred alternative, a working group was established composed of commercial and recreational fishers, conservationists, scientists, divers, concerned citizens and government agencies. An "ecosystem approach" was used which meant recommending alternatives based on natural resources instead of jurisdictional boundaries, and ecological as well as socio-economic information was gathered and considered during the meetings of the working group. In order to determine the socioeconomic impact of a closure on fishermen within the sanctuary, a social impact assessment was carried out through a system of surveys and informal conversation. A consultation of fishermen, charter boat captains, scientists etc. helped to identify what areas were being fished, which fish were found in those areas, and how much the fish were worth, and additionally the demographics of the fishermen were recorded. The information found was used to minimize the impact of no-take zones on the fishing community. Through this assessment, the following impacts of a no-take regulation were found: (1) moderate impacts on fishermen (mostly lobster and handline fishermen) and some recreational charter operators. (2) minimal or small impacts on recreational fishermen, commercial shippers, and treasure salvors. Due to the educational and research value of an ecological reserve, the potential benefits to non-consumptive users and scientists were deemed to be high. Through long-term fisheries replenishment, it was also suggested that positive effects to the surrounding areas were likely.

Sources: NOAA (2000) and NOAA Web site (2006)

In applying the ecosystem approach, there will be the need to move away from a sole focus on biological indicators, such as target species, towards ecological, societal, economic and institutional indicators that reflect broader sustainability objectives. However, this transition may be difficult as the existing problems with developing socio-economic indicators are plentiful, such as: lack of data availability due to confidentiality issues and lack of primary information; the non-market nature of certain effects; and the diversity of local contexts (fisheries), which complicates the definition of common indicators for international comparison (IEEP, 2005).

Various indicator frameworks exist and the choice of framework may reflect policy priorities or focus within the organizations and countries using or proposing them. IEEP (2005) suggests that, depending on the reference framework, indicators are defined by field (social, economic, institutional) or by type (pressure-state-response [PSR] or driving forces-pressures-state-impact-response [DPSIR]) (IEEP, 2005). A brief review of selected indicator frameworks is presented in Box 9. The FAO indicators for sustainable development of marine capture fisheries are attached as Appendix 6.3 at the end of this chapter.

Socio-economic monitoring

Socio-economic monitoring is the continuous or regular collection and analysis of social, cultural, economic and governance data of people, groups, communities and organizations, usually at specified intervals. An example of this is the international Socio-economic Monitoring Initiative for Coastal Management (SocMon) (Bunce *et al.*, 2000; Bunce and Pomeroy, 2003). SocMon, which is being implemented at global

BOX 9
Selected indicator frameworks

The FAO Sustainable Development Reference System (SDRS) integrates the four dimensions of sustainability: ecosystem, economy, community and governance. Basing indicators on a small number of key criteria or variables, appropriate indicators and related reference points (e.g. threshold values) can then be defined, depending on their purpose. The aim is to have a reference system that facilitates assessment of progress towards sustainability goals and evaluation of efficiency of management measures. This framework can be defined as a pressure-state-response (PSR) framework, which considers the pressure imposed by human activities on some aspects of the system, the state of that aspect and the actual or desired societal response. Defining indicators of pressures or driving forces may be useful as such forces are often the subject of management intervention.

The OECD focuses on the need for integrating social and economic components in the analysis, using two types of frameworks that link objectives, indicators and results: Firstly, an accounting framework aiming at integrating environmental aspects into public accounting, in physical and monetary units (e.g. the accounting of fishery resources in Australia). Secondly, an analytical framework in which the choice of indicators is related to the analysis of interactions between causes, effects and actions. The pressure-state-response (PSR) and the driving forces-pressure-state-impact-responses (DPSIR) frameworks can be used in the identification of such interactions.

However, some researchers suggest these are not well adapted to identify the dynamics of the socio-economic components as they were originally used to take into account environmental aspects in public policy development and not specifically for the socio-economic aspects.

As an additional tool, the OECD suggests the use of some indicators called "resources-results", in evaluating the preservation of environmental, economic and social assets.

The International Council for the Exploration of the Sea (ICES) is building from the precautionary approach framework to a framework which also considers societal benefits. In doing so, ICES is including a wider understanding of institutional and economic dynamics in a more comprehensive systems approach to fisheries management. As the former indicator framework focused mainly on biological sustainability, this systems approach integrates issues of uncertainty, risk, etc. to examine performance of fishery systems.

Australia provides one of the first examples of an indicator framework being implemented and adapted to the local context, and it is also being used to develop the FAO framework further. The Australian National Strategy on Ecologically Sustainable Development (ESD) contains three key objectives: intra-and intergenerational equity; enhancement of community well-being and welfare; and protection of biological diversity. The tree-shaped framework is divided in categories (e.g. contribution of the fishery to ecological well-being), and each category into components (e.g. retained species). By adapting each tree to the specific context of a fishery (management unit), criteria and indicators can be defined to follow up progress towards ESD objectives.

Yet another approach, being developed by Resources for the Future, is ecosystem benefit indicators, which are based on both biophysical and socioeconomic data, constructed and manipulated with GIS tools. Some indicators relate to the underlying production of the ecosystem and others relate to the demand for, and value of, the service. This framework can help identify benefit "hotspots", i.e. areas that generate valuable ecosystem services, by overlaying multiple maps of the relevant ecological and socioeconomic indicators. Criteria for what level of hotspot classification would trigger opposition to habitat alteration permits could possibly be developed through an expert consultation.

Sources: FAO (1999b), IEEP (2005), and Boyd *et al.* (2004)

and regional levels, is a set of guidelines for establishing socio-economic monitoring programmes at the coastal management study site level. It provides a methodology for regularly collecting basic socio-economic data useful for coastal management at the site

BOX 10

Evaluation of MPA management effectiveness

The evaluation of marine protected area (MPA) management effectiveness is about assessing the degree to which management actions are achieving stated goals and objectives (Pomeroy *et al.*, 2004). This tells us how well an MPA is doing by measuring performance through a series of indicators related to generic goals and objectives normally written in MPA management or strategic plans. Evaluation of MPA management effectiveness can be a component of the EAF system of indicators wherever MPAs are used as part of the management approach, often within the wider context of integrated management. MPAs are implemented for a myriad of reasons, and hence they differ in size, management structure and management and conservation goals among other features. However, from the perspective of human dimensions, the socio-economic and governance indicators (see table below) will be relevant to most MPAs even where the bio-physical characteristics are markedly different.

Socio-economic Indicators	Governance Indicators
Local marine resource use patterns	Level of resource conflict
Local values and beliefs re: the marine resources	Existence of a decision-making and management body
Level of understanding of human impacts	Existence and adoption of a management plan
Perceptions of seafood availability	Local understanding of MPA rules and regulations
Perceptions of local resource harvest	Existence and adequacy of enabling legislation
Perceptions of non-market and non-use value	Availability and allocation of MPA admin resources
Material style of life	Existence and application of science research and input
Quality of human health	Existence and activity level of community orgsanisations
Household income distribution by source	Degree of interaction between managers and stakeholders
Household occupational structure	Proportion of stakeholders trained in sustainable use
Community infrastructure and business	Level of training provided to stakeholders in participation
Number and nature of markets	Level of stakeholder participation and satisfaction in management process and activities
Stakeholder knowledge of natural history	Level of stakeholder involvement in surveillance, monitoring, and enforcement
Distribution of formal knowledge to community	Clearly defined enforcement procedures
Percent of stakeholder group in leadership positions	Enforcement coverage
Changes in conditions of ancestral and historical sites, features, and/or monuments	Degree of information dissemination to encourage stakeholder compliance

A well-established process of evaluation has been developed, which can be tailored to the situation at hand, and underscores the need to clarify the management questions before defining the relevant indicators (see corresponding guidebook for details on the method).

Sources: Pomeroy *et al.* (2004)

level, and provides a basis for a regional system by which site-level data can feed into national, regional and international databases for comparison. SocMon is also intended to provide insight to managers, many of whom come from biology backgrounds, into what "socio-economics" means, how socio-economic information can be useful to their management, and what socio-economic data might be useful for management at their site.

The SocMon initiative uses a standard set of variables that can be tailored to site-specific situations. It can be used in EAF to monitor and evaluate the performance of interventions on specific geographic areas paying special attention to communities and households within and outside of the fisheries sector. Some typical SocMon variables include:

TABLE 2
Example SocMon variables

Demographic	Perceptions and attitudes
Age	Perceptions of resource conditions
Gender	Perceived threats
Ethnicity	Perceived coastal management problems
Education	Perceived coastal management solutions
Religion	Perceived community problems
Language	Successes in coastal management
Occupation	Challenges in coastal management
Household size	**Governance**
Household income	Awareness of rules and regulations
Resource use	Compliance
Household activities	Enforcement
Household goods and services	Participation in decision-making
Types of household uses	Membership in stakeholder organizations
Household market orientation	**Quality of life**
Non-market and non-use values	Material style of life

Systems of national accounts

In seeking to attain sustainability, it has long been argued that there is a pressing need to change the way in which national progress is currently evaluated, i.e. to move beyond national accounts confined primarily to the goods and services that pass through the market and the provision cost of government-supplied services. This evaluation system tends to ignore the fact that economic progress often has been achieved at the expense of the environment, hence a complement to this accounting framework has been sought in the shape of a "green GDP", or green national accounting (Repetto *et al.*, 1989). Such an approach is compatible with the goal of EAF to incorporate ecosystem values into fishery decision-making.

One example of this is to use satellite accounts – Systems of Environmental and Economic Accounts (SEEA)[18] – in the system of national accounts (SNA). This provides a way of making the important functions and services of the environment more tangible by incorporating these into the economy, in the shape of satellite accounts. These accounts record **stocks** and **flows** of environmental goods and services, including information about critical stocks and flows that may affect fisheries. By linking environmental information/data to economic accounts, and covering all important environmental-economic interactions, SEEA constitutes a way of overcoming the division between economic and environmental analysis. In addition, a wide range of sustainability indicators could be included in these satellite accounts (FAO, 2004a).

The three main categories of issues that can be addressed through SEEA for Fisheries (SEEAF), as described by FAO (2004a) are:

1. Monitoring of the economic importance of fisheries, e.g. contribution of fisheries to national income and employment; economic linkages between the fisheries sector and other sectors; value of natural assets, and the cost of depletion.
2. Improvement of fisheries management, e.g. assessment of government policies (taxes and subsidies) on the sustainable use of fisheries resources; monitoring of the ecosystem health, fisheries and the natural resource base.
3. Estimation of the full costs and benefits of fisheries, e.g. assessment of the government fisheries management costs and habitat protection costs.

[18] For a discussion on the integration of ecosystem services and their flows into national accounts is presented in Weber (2007).

Four categories of accounts exist (FAO 2004a):

1. **Asset accounts** – information about stocks and changes in stocks of natural resources.
2. **Flow accounts** for pollution, energy and materials – information about the use of energy and materials as inputs to production and final demand, and the generation of pollutants and solid waste.
3. **Environmental protection and resource management expenditure accounts** – information about expenditures of industry, government and households for protection of the environment or management of resources. Taxes and property income received from the sale of fishing licenses or purchase of the right to fish etc. are also included in this account.
4. **Environmentally-adjusted macroeconomic aggregates** – adjustments to existing country-level key financial and economic data for the depletion and degradation of environmental assets.

According to FAO (2004a), the SEEAF **asset accounts** cover:

1. Produced assets – capital used for fishing and manufacturing of fish products (e.g. boats, fishing gears), and cultivated fisheries (e.g. aquaculture).
2. Non-produced assets – e.g. wild fish stocks, water ecosystems (providing habitats for fishery resources).

while the SEEA **flow accounts** cover:

1. Expenditures for protection of fish habitats and resource management accounts by industries and households.
2. Activities of industries that provide environmental protection services.
3. Environmental and resource taxes and subsidies.

How can these satellite accounts aid policy-makers? SEEA is a useful tool for ministries when attempting to coordinate policies in cases of cross-sectoral impacts, as it provides information for weighing alternatives and making trade-offs. An example of this could be when considering changes in land use in coastal areas. By being able to assess the economic value of fishing in this broader sense, policy-makers can easier link information about fisheries to the broader economy, and thus possibly integrate fisheries policy with national development in a more plausible way (FAO, 2004a).

Which are the main areas for improvement in the use of fisheries accounts for policy analysis? Firstly, these accounts are still only being used by a small number of countries, partly due to the small economic role of fisheries in most countries, and partly because of the amount of uncertainties relating to stocks, future stocks, and the value of stocks. Secondly, little research has focused on artisanal and subsistence fisheries. This possibly stems from the often low economic value of small-scale and subsistence, however, they may be vital in terms of providing livelihoods in both industrialized and developing countries, and are likely to expand because of population growth and improved access to better fishing equipment. Thirdly, sustainable fisheries management requires taking into account of all environmental services such the values of existence, tourism and recreation, to a greater extent. Fourthly, a specific problem lies in creating accounts for straddling and highly migratory stocks, and high seas fish stocks, outside EEZs, as there is, at the present, very little information about the value of these fish stocks (FAO, 2004a). Related to this is also the issue of "double-accounting" of straddling stocks, meaning that the same stock is accounted for in more than one country's accounts.

Further areas which provide complex topics for discussion are: first, the valuation of non-market benefits (e.g. biodiversity) – it has been suggested that national accountants' reluctance to put monetary values on such benefits stems from the great degree of judgment which is required in the estimation of non-market values (Atkinson, 2000); second, the attribution of production to the country of residence of the operator, and not to the country of registration of the vessel, due to the problem of

"flags of convenience", however the determination of residence of the operator of the fishing vessel has no reference to where the fish is caught or landed.

Scenario modelling and simulations

Given the complexity of fishery systems, it is difficult to predict possible future changes in the fishery, and particularly the likely outcomes of management interventions, without systematic tools to assist. This complexity increases in the EAF as a broader range of factors needs to be considered. However, it is still important to be able to explore EAF situations or scenarios in a sufficiently simple manner, without being simplistic – so that well-informed policy and planning decisions can be made by a variety of stakeholders with diverse backgrounds and perspectives. In this context, scenarios and simulations are important and powerful tools for supporting decision-making.

Scenarios and simulations are based on the idea of a "model" – a tool to represent the real world in a form that can be analysed reasonably easily, thus allowing us to explore the implications of management options prior to implementing them in practice. A model can be expressed verbally (in words), diagrammatically (using graphs), physically (in scale models) or with mathematical notation and computer programs. The latter type of model allows us to experiment with fisheries management options through a "safe" computerized approach that avoids the cost, time, and potential danger of implementing un-tested management directly in the fishery. With a computer model, one can use "simulation" to explore a range of "scenarios" – potential future realities, based on assumptions about how the world will evolve, together with a choice of management decisions – to see what implications might arise for each scenario.

Since scenarios typically involve both ecosystem and human elements of the fishery, an important form of model is the "integrated" model which – in contrast to purely economic or biological models – combines the various components of the fishery in a single model. Integrated models (such as bio-economic models, discussed elsewhere) provide the means to examine the many interrelationships among fish, fishers, fleets and post-harvest elements of the fishery. In this way, simulations mimic the dynamics of actual fisheries – changes over time in fish populations, fishing fleets, people in the fishery, and management agencies – so as to predict the effects of fishery management decisions.

In general, it is desirable for fishery models to be such that (a) information requirements are not excessive, (b) the model can be directly used in or adapted to a range of fisheries, and/or (c) participatory processes are used in creating the model. It is useful to note as well that scenario modelling or simulation analysis requires "fitting" the model, and this in turn requires a range of suitable time series of data, including some not always associated with the fishery itself (such as regional labour conditions, migration rates and human population trends, where relevant).

Bio-economic models

Bio-economic models are representations of the biological and economic structure and dynamics of fisheries. These models expressly link economic aspects with their biological foundations and range from relatively simple models of profit maximization subject to fish population dynamics, to more complicated multifleet, multispecies models with complicated growth functions and interaction variables. Tractability, representative capacity and data availability, with their related costs, of these models are major factors in determining their degree of descriptive power.

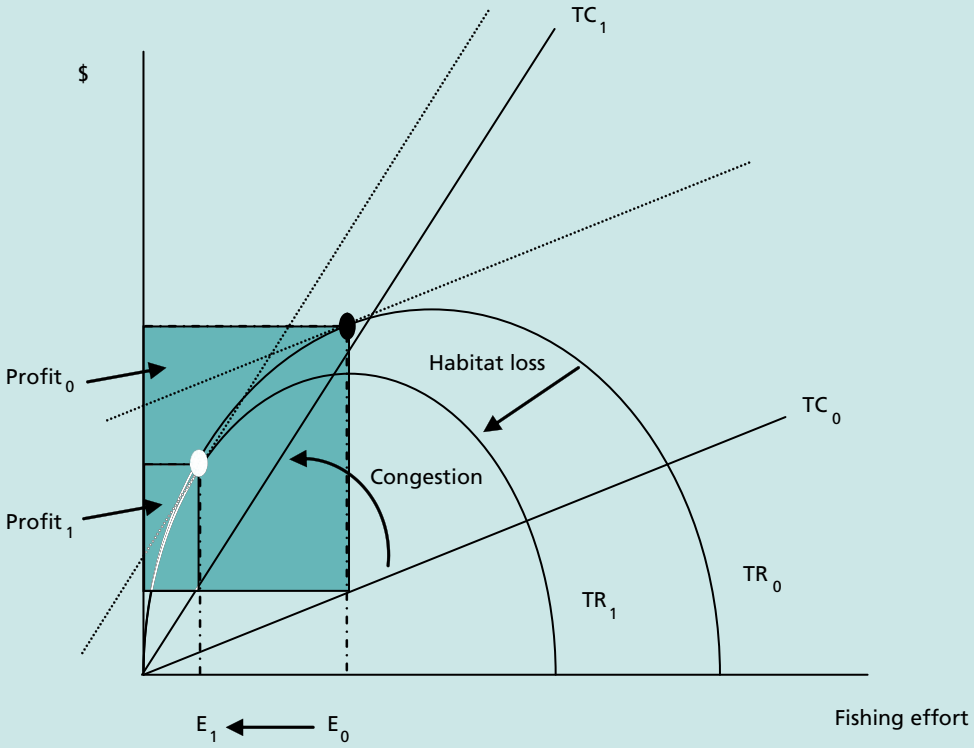
Seijo *et al.* (1998) provide a review of the theory and practice of static and dynamic bio-economic models and their use in management planning. Such models are very powerful policy analysis tools in that economic efficiency gains and losses may be estimated for a variety of possible fishery management portfolios, institutional

BOX 11

Graphic representation of effort and profit changes in a bio-economic model

The following figure demonstrates the economic efficiency loss from fishery habitat loss (in quality or quantity) in a regulated (assumed profit maximizing) fishery. The lower total revenue curve per unit of fishing effort (from TR_0 to TR_1) is caused by the reduced ability of the ecosystem to sustain the original fish species abundance. The rotating upward of the total cost curve (from TC_0 to TC_1) is, for example, due to increased congestion among the vessels fishing in smaller zones.

Fishing effort goes down from E_0 to E_1 (this effort probably being displaced to other fisheries) and net profit decreases from shaded area $Profit_0$ to the shaded area $Profit_1$; representing a loss to society.



Source: Boyd *et al.* (2004)

structure, and biological growth assumptions. These models lend themselves to graphic representation, allowing for pictorial descriptions of changes in fishery outcomes from any changes within and without the fishery.

Bioeconomic models are now being applied to EAF-related topics. For example, Boyd *et al.* (2004) present a bio-economic model that shows how the quality of the ecosystem affects fishery activities – specifically how fishing effort is affected by changes in habitat (either in quality or quantity), as well as changes in management framework and in knowledge about stock dynamics. Box 11 presents a graphic representation of this model showing the effects of habitat changes on fishing effort under open-access and regulated access situations.

The discount rate

As mentioned above, the costs and benefits of implementing the EAF, or any management decision for that matter, will have a time dimension that will need to be

considered. The time element comes from the fact that a management action today may have immediate benefits and costs, benefits and costs that arise far in the future, or any mix between the two. If people valued events in the future as they value events in the present, this time spread of costs and benefits would not be an issue. However, this is not the case and, in fact, poses some fundamental ethical questions. If, for example, the decision was taken today to exhaust a fishery resource in order to provide food for the immediate generation but would make it more difficult for future generations to fish for food, how should one weight the impacts on the various generations? Do we care more, less, or equally about current generations or future generations? What if a management action were to imply high immediate costs and benefits only in the long-term, say, in three generations? Should we still undertake this action?

Complicating the issue is that no two individuals or groups share exactly the same values for costs and benefits along a time line. A politician may have no value for impacts occurring after his political lifespan. A conservationist may value any improvements in ecosystem services, regardless of when they occur. A large fishing corporation may value the resource only during the expected lifetime of the corporation. Traditional fishers may value the resource for their own use but also feel a responsibility to maintain the resource for use by their children, grandchildren, and so on. A fishmonger may prefer to sell fish today in order to invest the money in a different activity. Any given stakeholder has his own time value, whether defined consciously or not.

To acknowledge that a "dollar tomorrow" does not have the same value as a "dollar today", a discount rate is used in decision-making tools that compare costs and benefits across generations, such as those mentioned previously. The higher the discount rate, the less value we place today on costs and benefits that will come at some point in the future. If the discount rate is zero, future costs and benefits have the same value (are weighted equally) as immediate costs and benefits. If greater than zero, then the "present value" (as seen today) of a particular cost or benefit that occurs in a future year is lower than the equivalent "present value" of the same cost or benefit if it occurs today.

Therefore, any positive discount rate will favour actions with short-term benefits or long-term costs. Actions having short-term costs and long-term benefits will have a harder time being accepted until the cost-benefit framework. As ecosystem restoration or preservation projects entail long-term benefits with short-term costs, these projects would look less interesting from an economic perspective than other projects with short-term benefits, such as those that would immediately use ecosystem services.

A challenge in implementing the EAF lies in the difference between "social" and "private" perspectives on discounting. Whatever may be the societal view of the balance of present and future generations, EAF management must deal with the reality that from a private viewpoint (Sumaila, 2005):

- people are generally impatient and display a preference for having their benefits today rather than tomorrow (due to uncertainty, high debt levels, poverty, etc.); and
- money might otherwise be invested elsewhere (the opportunity cost of capital) with even higher interest on the investment.

In a fishery context, the first of these could imply a relatively high discount rate among fishers, and thus a challenge in gaining support for longer-term objectives of ecosystem health. The second will vary depending on the circumstances in which the fishery and fishing community/industry finds itself and its effect on fishing activities is less straightforward.

How to determine a suitable discount rate to meet societal needs has been a subject of abundant discussion in fisheries and indeed throughout society. For example, Farber and Hemmersbaugh (1993) present some of the practical and philosophical issues in using and choosing discount rates, and Pearce *et al.* (2006) address some current issues

of the debate as well as providing some guidance for decision-makers on the choice and use of discount rates. In fisheries, the policy implications can be enormous. Sumaila and Walters (2005) note that sustainability mandates around the world, including EAF, require "that future generations have the benefit of inheriting 'healthy' natural and environmental resources". However, Cochrane (2006) notes that when no alternatives to fishing exist and/or individuals are highly dependent on fisheries to meet basic needs, special consideration is needed – in such cases, private discount rates tend to be very high and policy remedies are particularly difficult.

CONCLUSIONS

This chapter has focused on understanding, measuring and assessing the impacts of moving to the ecosystem approach to fisheries, including a set of decision support tools for EAF. The first part of the chapter provided an examination of the various potential benefits and costs of EAF management, from social, economic and management perspectives, as well as in terms of implications within the current EAF guidelines themselves, together with a brief discussion of the practical challenges involved in measuring these various benefits and costs. The second part of the chapter focused on methods for assessing the consequences of EAF management, and therefore making decisions about EAF implementation. These methods and approaches included cost-benefit analysis, social impact assessment, indicator frameworks, systems of national accounts, bio-economic models, and applying the discount rate.

It should be highlighted in closing that the discussion in this chapter provides only some starting points for addressing the major challenges involved in predicting and assessing the impacts of EAF implementation. Only brief outlines were given of each approach presented here, there are other methods to be considered beyond these, and the discussion here has been generic in nature, with the specifics of a given fishery needing incorporation for any practical analysis of EAF implementation. Nevertheless, it is hoped that the material in this chapter can be built upon to support those engaged in developing and implementing EAF management.

APPENDIX 6.1
Benefits and costs arising in the EAF guidelines

This appendix extracts some specific pieces of the current EAF guidelines with particular implications, whether in terms of benefits and/or costs (Tables 1–3), areas of research that could improve EAF implementation (Table 4) or human considerations

TABLE 1
Moving towards EAF management (Section 1.4 in the FAO EAF Guidelines)

1.4.1 The fisheries management process

…Recognizing the broader economic and social interests of stakeholders under EAF, the setting of economic and social objectives will need a broader consideration of ecological values and constraints than is currently the case. This will require a broader stakeholder base, increased participation and improved linkages of fisheries management with coastal/ocean planning and integrated coastal zone management activities…

1.4.2 Biological and environmental concepts and constraints

Current management practices tend to give insufficient recognition to the fact that many components are intrinsically linked… in a complex flow of material, energy and information.

…to be able to implement EAF at an operational level, delineation of the "boundaries" is required and can be achieved by a sensible consensus based on proposed EAF objectives.

1.4.3 Technological considerations

Gear modifications, such as those used to selectively harvest the target species and minimize unwanted bycatch… will take on increasing importance as ecological objectives are broadened...

The impact of some fishing gear and methods on the bottom habitat (biotic and abiotic) can often have a negative effect on the ecosystem…the introduction of restrictions may be necessary and, where possible, new technologies that mitigate any negative impact will need to be developed.

Fishing operations may also cause other negative impacts to the environment... Minimizing such impacts will require development and successful introduction of alternative cost-effective technologies and fishing practices.

Many ecosystems, especially those in coastal waters, are impacted not only by fisheries, but also by other users, including upstream land-based activities.

1.4.4 Social and economic dimensions

…as the overarching goal of EAF is to implement sustainable development, the shift to EAF will entail the recognition of the wider economic, social and cultural benefits that can be derived from fisheries resources and the ecosystems in which they occur.

The identification of the various direct and indirect uses and users of resources and ecosystems is a necessary first step to attain a good understanding of the full range of potential benefits.

Many ecosystem goods and services are not traded, and therefore need to be valued through means other than market prices.

The consideration of a broader range of ecosystem goods and services necessarily implies the need of addressing a wider range of trade-offs between uses, non-uses, and user groups.

EAF provides a framework within which traditional fisheries management practices can be recognized and strengthened to address some of these problems.

EAF is better suited… to handle impacts arising from destructive fishing practices, habitat degradation and pollution, and to use traditional ecological knowledge...

EAF must… take into account the dependence of artisanal and small-scale fishing communities on fishing for their life, livelihoods and food security.

1.4.5 Institutional concepts and functions

One of the implications of implementing EAF is an expansion of stakeholder groups and sectoral linkages. This may have substantial impact on institutional structure and process, in terms either of creating new structures or strengthening existing institutional collaboration.

An effective ecosystem approach will depend on better institutional coordination (e.g. between ministries).

A greater emphasis on planning at a range of geographical levels that involves all relevant stakeholders will be required...

Management units may need to be redefined geographically or, at the very least, coordinated within a larger-scale planning process.

In most countries, EAF will require considerable capacity building. This will include… training managers and regulators to deal with a broader range of options and trade-offs, conflicts, rights and regulations; and enhancing stakeholder capacity to participate.

1.4.6 Time scales

The FM Guidelines recognize three time scales of immediate relevance to the fisheries management process… These will also apply to EAF…

1.4.7 Precautionary approach

Under EAF… the principle is much broader than just environmental degradation, and applies to any undesirable outcome (ecological, social or economic)...

1.4.8 Special requirements of developing countries

The challenge to implement improved fisheries management… may be particularly formidable in small-scale fisheries, where the difficulty and costs of the transition to effective management may outweigh the available capacity and short-term economic benefits derived from it.

that could pose threats to successful implementation of EAF (Table 5). The following five themes are covered:

1. Moving towards EAF management (from EAF Guidelines section 1.4)
2. Options to manage fishing (from EAF Guidelines section 3.2)
3. Legal and institutional aspects of EAF (from EAF Guidelines section 4.2)
4. Research for an improved EAF (from EAF Guidelines section 5)
5. Threats to implementing EAF (from EAF Guidelines section 6)

TABLE 2
Options to manage fishing (Section 3.2 in the FAO EAF Guidelines)

3.2.1 Technical measures

3.2.1.1 gear modifications that improve selectivity

Size selectivity of target species

Non-target species selectivity

3.2.1.2 Other gear issues

3.2.1.3 Spatial and temporal controls on fishing

"Area closures that permit some fishing may require a large enforcement effort and can therefore be costly. Allowing certain categories of fishing activity can also create loopholes which undermine the intentions of the closure. Management authorities need to consider the likely degree of compliance and enforcement costs in establishing closures..."

3.2.1.4 Control of the impact from fishing gear on habitats

"Fishing gear that touches or scrapes the bottom during fishing operations is likely to produce negative impact on the biotic and abiotic habitats... Use of towed gear with reduced bottom contact is a technical option in such areas. Prohibition of certain gear in some habitats is another, e.g. trawling in coral reef and seagrass areas. A third option is to replace a high-impact fishing method with one with less impact on the bottom, e.g. trapping, longlining or gillnetting."

3.2.1.5 Energy efficiency and pollution

"Energy optimization can be achieved through improved efficiency of fishing gear as well as through improved management that lead to less fishing effort being required."

3.2.2 Input (effort) and output (catch) control

3.2.2.1 Controlling overall fishing mortality

Capacity limitation

Effort limitation

3.2.2.2 Catch controls

3.2.3 Ecosystem manipulation

3.2.3.1 Habitat modifications

Preventing habitat degradation

Providing additional habitat

3.2.3.2 Population manipulation

Restocking and stock enhancement

Culling

Intentional introductions

3.2.4 Rights-based management approaches

"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."

EAF requires that all the uses and users of a fishery resource be considered and reconciled, and that interactions between different fisheries within the designated geographic area be taken into account.

TABLE 3
Legal and institutional aspects of EAF (Section 4.2, FAO EAF Guidelines)

4.2.1 Legal

EAF is… likely to require more complex sets of rules or regulations that recognize the impacts of fisheries on other sectors and the impact of those sectors on fisheries. It may be desirable to regulate the major and more or less constant intersectoral interactions through the primary legislation. This could apply, for example, to laws controlling coastline development and coastal habitat protection, the establishment of permanent MPAs, and the creation of cross-sectoral institutions.

4.2.2 Institutional

The development and implementation of EAF policy and legislation will most naturally be undertaken by the national fisheries department or designated management agencies (at national level) and the fisheries management organizations (at regional level). A major problem in EAF development may stem from disparities between the ecosystem and jurisdictional boundaries and these disparities will need to be addressed…

The number of conflicts will inevitably increase under EAF as the number of stakeholders and objectives increase.

EAF will require adherence to the same principles of transparent and participatory management… such as devolution of decision-making and management responsibility; building capacity at the devolved level; appropriate participation of stakeholders in decision-making; improved transparency and dissemination of more information; establishment (or confirmation) of appropriate systems of user-rights.

While some level of devolution of responsibility and authority to the lowest levels (the local community) will be desirable, this decision must be reconciled with the need to ensure that management decisions and actions are coordinated and consistent at the higher levels required by EAF in each case. This will require effective institutional structuring to coordinate decisions and actions at the broader geographical and fishery scales required by EAF.

Limiting access and implementing appropriate systems of access rights are essential for successful and responsible fisheries under TROM (FM Guidelines, 3.2) and are expanded for EAF. Under EAF, it must be recognized that the access rights system will frequently need to encompass other uses in addition to the use of the target resources currently included in TROM.

4.2.3 Educating and informing stakeholders

Successful implementation of EAF will require that stakeholders (including management agencies) understand and accept the need for this more inclusive approach to fisheries management, and management agencies should actively promote such understanding and acceptance.

Conversely, scientists and management authorities need to appreciate and use the knowledge of fishers themselves about the ecosystem, along with that of their representatives and communities.

4.2.4 Effective administrative structure

Administrative structures under EAF will continue to reflect the variety of government systems that exist under TROM and related management approaches. However, they will have to be better integrated with more effective roles in auditing or oversight.

TABLE 4

Research for an improved EAF (Chapter 5 in the FAO EAF Guidelines)

Some relevant areas of research that would lead to improved ability to implement effective EAF are listed below. The order does not reflect any particular priority.

5.1 ecosystems and fishery impact assessments
1. Obtain better information on how ecosystems function, especially in terms of interspecies interactions, and how these lead to higher ecosystem properties.
2. Expand knowledge of how fishing impacts target stocks.
3. Conduct research into the impact of fishing on non-target species through bycatch and discarding and what it is doing to food-web interactions, habitats and biodiversity.
4. Develop appropriate multispecies bio-economic models, as well as extended ecological models that include the economic and social dimensions.
5.2 socio-economic considerations
5. Conduct research into the factors that influence the day-to-day behaviour of vessel operators/skippers, especially with regard to the choice of fishing gear and fishing ground, and levels of discarding.
6. Apply economic valuation methods, including the pros and cons of different methods in different circumstances.
7. Apply an integrated environmental and economic accounting framework to the assessment and analysis of the interaction between fisheries and other sectors of the economy.
5.3 assessment of management measures
8. Conduct research and develop technology in the area of fishing gear and practices to improve gear selectivity and reduce the impact of gear on ecosystems.
9. Develop strategies/procedure to assess and integrate traditional ecosystem knowledge into management.
10. Identify the species (and ecosystems) that are suitable for restocking/ stock enhancement programmes, and develop more adequate release strategies for them.
11. The potential of MPAs (a biodiversity conservation measure) as a fisheries management measure needs to be better assessed, including research to clarify where MPAs will be most effective.
12. Artificial habitats are another area for research in terms of their usefulness and effectiveness for fisheries.
13. Culling is controversial topic requiring further research. A thorough review of global experiences would be informative.
5.4 assessment and improving the management process
14. The many steps in the management process itself… could benefit from further research. For instance, research is needed on how better to compile data for management plans, how to evaluate management performance, and how to include uncertainty and risk assessments in the process.
15. Development of better participatory processes is critical, and sociological research on how to improve the consultation process with stakeholders will become increasingly important. Sociological research will also be required for assessing the impact of different management measures on the varied stakeholders and minimizing undesirable impacts.
16. Better ways of communicating the implications of different management strategies need to be developed.
5.5 monitoring and assessments
17. The broadening of issues to be considered in the context of EAF will also require the development of simpler, more rapid appraisal methods [and] adaptive management approaches to assist with data-poor situations.
18. Develop several analytical techniques to underpin the decision-making process, including analyses to assist in setting reference points, and to evaluate potential decision rules.
19. Although specific objectives, indicators and reference points will vary among fisheries, a set of generic indicators needs to be identified.

TABLE 5
Threats to implementing EAF (Chapter 6 in the FAO EAF Guidelines)

	Benefits of Avoiding or Overcoming the Threat	Costs in Avoiding or Over-coming the Threat
1. The mismatch between expectations and resources (both human and financial) will need to be carefully managed. EAF has much to offer, but lack of investment in the process will certainly slow progress and might mean failure in the end. The differing timetables of the political and the management process may also mean that insufficient commitment and resources are made available. EAF is a long-term commitment with long-term benefits, which may be difficult to present convincingly to governments, which normally work in shorter cycles, and especially when EAF competes with short-term socio-economic objectives.		
2. Difficulty may be foreseen in reconciling competing objectives of the multiple stakeholders. In some, perhaps many, cases the participatory process may be insufficient for finding compromises that satisfy all stakeholders. Conflicts may then require higher-level intervention to determine the relative priorities and possibly, compensation.		
3. Insufficient or ineffective participation of stakeholders in the development and implementation of EAF may occur, even when competing objectives can be reconciled. This deficiency could be caused by a number of factors including: an unwillingness of stakeholders to participate openly and transparently in the process or to make concessions…; inadequate and fuzzy user rights that fail to recognize long-term interests and responsibilities leading to poor stewardship; a lack of access to necessary information; inadequate consultation process or arrangements; insufficient resources being invested to improve fisheries and their management; a lack of capacity to participate effectively…; and hidden agendas.		
4. The time and cost required for effective consultation with a wide range of stakeholders could be substantial.		
5. Insufficient knowledge will continue to be a constraint. Biological uncertainty is recognized as a substantial problem in management of fisheries under "TROM", and the combined biological and ecological uncertainty under EAF will be even greater. One manifestation of this will be an inability in some instances to identify meaningful, cost-effective indicators for important objectives. The sum of these uncertainties will require robust and precautionary approaches that could cause substantial difficulties in some cases for certain stakeholders, both social and economic. A further source of uncertainty is a widespread lack of adequate knowledge of fleet and fisher behaviour and dynamics.		
6. A lack of adequate capacity for informative compilation and analysis of the available information will often add to the uncertainty. In cases where there are or have been inadequate monitoring and data storage systems in place, the problems will be particularly acute.		
7. Insufficient education and awareness will also be a problem. This will apply to all stakeholders in exercising their responsibilities, including the fishery management agencies and the public, who will need to be better educated on their roles.		
8. Equity issues will always be difficult to resolve in relation to responsibility for ecosystem degradation, between fisheries and other economic activities such as agriculture (including forestry), chemical industries, urban and coastal development, energy and tourism.		
9. Aligning the boundaries of the ecosystems and of the jurisdictions of the management authorities (whether at regional, national or sub-national levels), as well as between jurisdictions of the different authorities responsible for competing sectors, will continue to be a challenge. Transboundary issues will require particular attention. As foreseen in the United Nations Fish Stock Agreement (UNFSA), EAF measures adopted by different countries sharing an ecosystem will need to be compatible across the whole geographical range of the ecosystem.		
10. Another impediment … is illegal stakeholder behaviour: illegal fishing, lack of implementation of flag state and port state responsibilities, and misreporting. While these types of practices continue, it is difficult to see how the principles and processes outlined in these guidelines can be implemented successfully, especially on the high seas. The compliance agreement and the international plan of action on illegal, unreported and unregulated fishing should play a useful role in changing this situation for the future.		
11. Poverty is a major threat to EAF. While poor coastal dwellers have few other options to derive livelihoods, fishing will continue to be the occupation of last resort for growing and displaced populations, resulting in excessive fishing effort, depletion of resources and ecosystem degradation. This will often occur in desperate circumstances where the incentive to care for the ecosystem is overshadowed by daily necessities.		

APPENDIX 6.2
Related environmental decision-making tools

The following are decision-making tools that are commonly used in environmental economics/decision making, which, with certain adjustments in their application, may be relevant for an EAF context. Unless otherwise noted, the material in this appendix has been abridged from Pearce *et al.* (2006).

Environmental impact assessment (EIA) or environmental assessment (EA)

EIA is a systematic procedure for collecting information about the environmental impacts of a project or policy, and for measuring those impacts. It ignores non-environmental impacts and it ignores costs. It may not account in a detailed way for the ways in which impacts vary with time. EIA is an essential input to CBA. Most EIAs do make an effort, however, to assess the significance of environmental impacts. Some may go further and give the impacts a score (the extent of the impact) and a weight (its importance). Weights might be derived from public surveys but more usually are determined by the analyst in question. Unlike CBA, EIA has no formal decision rule attached to it (e.g. benefits must exceed costs), but analysts would typically argue that its purpose is to look at alternative means of minimising the environmental impacts without altering the benefits of the project or policy.

Strategic environmental assessment (SEA)

SEA is similar to EIA but tends to operate at a "higher" level of decision-making. Instead of single projects or policies, SEA would consider entire programmes of investments or policies. The goal is to look for the synergies between individual policies and projects and to evaluate alternatives in a more comprehensive manner. An SEA is more likely than an EIA to consider issues like: is the policy or project needed at all; and, if it is, what are the alternative options available? In this sense, SEA is seen to be more pro-active than EIA which tends to be reactive. Proactive here means that more opportunity exists for programmes to be better designed (from an environmental perspective) rather than accepting that a specific option is chosen and the task is to minimise environmental impacts from that option. Again, while it encompasses more issues of concern, SEA remains non-comprehensive as a decision-guiding procedure. Issues of time, cost, and non-environmental costs and benefits do not figure prominently. Relative to the benchmark of CBA, SEA goes some way to considering the kinds of issues that would be relevant in a CBA.

Cumulative impacts assessment (CIA)

Cumulative impacts or effects assessment (CIA) refers to systems for measuring impacts on the natural and social environments that either (a) take place so frequently in time or so densely in space that they cannot be assimilated; or (b) occur when the impacts of one activity combine with the activities of another in a synergistic manner (CEARC, 1988). Significant cumulative environmental impacts are often the result of aggregated or synergistic individual impacts, even if one by one, they are considered insignificant. Hence it is essential to effectively assess and manage for cumulative impacts, not only their individual components. However, cumulative effects can be difficult and expensive to assess. Methods are required which can address multiple projects, multiple resources and the interactions among impacts. Employing CIA may be necessary in EAF due to the large number of activities impacting on any ecosystem.

Life cycle analysis (LCA)

LCA is similar to EIA in that it identifies the environmental impacts of a policy or project and tries to measure them. It may or may not measure the impacts in the same

units, any more than EIA tries to do this. Typically, when attempts are made to adopt the same units they do not include money, although some LCAs have done this. The chief difference between EIA and LCA is that LCA looks not just at the impacts directly arising from a project or policy, but at the whole "life cycle" of impacts. Included in the analysis would be the environmental impacts of primary resource extraction and the impacts from landfill, incineration etc. LCAs proceed by establishing an inventory of impacts and then the impacts are subjected to an assessment to establish the extent of impact and the weight to be attached to it. Relative to the benchmark of Cost-Benefit Analysis, LCA is essentially the physical counterpart to the kind of environmental impact analysis that is required by a CBA. In itself LCA offers no obvious decision rule for policies or projects. Though widely advocated as a comprehensive decision-guidance tool, LCA does not (usually) consider non-environmental costs and benefits. Hence it is not a comprehensive decision guide. However, if the choice context is one where one of several options has to be chosen, then, provided other things are equal, LCA operates like a cost-effectiveness criterion (see below).

Risk assessment (RA)

Risk assessment involves assessing either the health or environmental risks (or both) attached to a product, process, policy or project. Risk assessments may be expressed in various ways:

- As the probability of some defined health or ecosystem effect occurring, e.g. a 1 in 100 000 chance of mortality from continued exposure to some chemical.
- As a number of incidences across a defined population, e.g. 10 000 premature deaths per annum out of some population.
- As a defined incidence per unit of exposure, e.g. X percent increase in premature mortality per unit air pollution.
- As a "no effect" level of exposure, e.g. below one microgram per cubic metre there may be no health effect.

Risk assessments may not translate into decision rules very easily. One way they may do this is if the actual or estimated risk level is compared to an "acceptable" level which in turn may be the result of some expert judgement or the result of a public survey. A common threshold is to look at unavoidable "everyday" risks and to judge whether people "live with" such a risk. This may make it acceptable. Other procedures tend to be more common and may define the acceptable level as a no-risk level, or even a non-risk level with a sizeable margin or error. Procedures establishing "no effect" levels, e.g. of chemicals, define the origin of what the economist would call a "damage function" but cannot inform decision-making unless the goal is in fact to secure that level of risk. Put another way, "no effect" points contain no information about the "damage function".

Comparative risk assessment (CRA)

CRA involves analysing risks but for several alternative projects or policies. The issue is then which option should be chosen and the answer offered by CRA is that the option with the lowest risk should be chosen. Efforts are made to "normalize" the analysis so that like is compared to like. For example, one might want to choose between nuclear energy and coal-fired electricity. One approach would be to normalise the risks of one kilowatt hour of electricity and compute, say, deaths per kWh. The option with the lowest "death rate" would then be chosen. However, in this case, the normalization process does not extend to cost, so that CRA may want to add a further dimension, the money cost of generating one kWh. Once this is done, the focus tends to shift to cost-effectiveness analysis – see below. A further problem concerns the nature of risk. "One fatality" appears to be a homogenous unit, but if people are not indifferent to

the manner of death or whether it is voluntarily or involuntarily borne, then, in effect, the normalization has failed. Once again, one can see that CRA is not a comprehensive decision-guide since the way it treats costs (if at all) may not be all-embracing. Nor would CRA deal with benefits.

Risk-benefit analysis (RBA)

RBA tends to take two forms, each of which is reducible to another form of decision rule. In other words, RBA is not a separate procedure. The first meaning relates to benefits, costs and risks, where risks are treated as costs and valued in money terms. In that case the formula for accepting a project or policy would be: [Benefits – Costs – Risks] > 0. This is no different to a CBA rule.

In the second case the RBA rule reduces to CRA. Benefits might be standardized, e.g. to "passenger kilometres" and the risk element might be fatalities. "Fatalities per passenger kilometre" might then be the thing that should be minimized. As with CRA, cost may or may not enter the picture. If it does, then RBA tends to result in CBA or cost-effectiveness analysis.

Risk-risk analysis (RRA)

RRA tends to focus on health risks and asks what would happen to health risks if some policy was adopted and what would happen if it was not adopted. The "with/without" focus is familiar in CBA. The novelty tends to be the fact that not undertaking a policy may itself impose costs in terms of lives or morbidity. For example, a policy of banning or lowering consumption of saccharin might have a justification in reducing health risks from its consumption. But the with-policy option may result in consumers switching to sugar in place of the banned saccharin, thus increasing morbidity by that route. The advantage of RRA is that it forces decision-makers to look at the behavioural responses to regulations. Once again, however, all other components in a CBA equation are ignored, so the procedure is not comprehensive.

Health-health analysis (HHA)

HHA is similar to RRA but instead of comparing the risks with and without the behavioural reaction to a policy, it compares the change in risks from a policy with the risks associated with the expenditure on the policy. As such, it offers a subtle focus on policy that is easily overlooked. Since policies costs money, the money has to come from somewhere and, ultimately, the source is the taxpayer. But if taxpayers pay part of their taxes for lifesaving policies, their incomes are reduced. Some of that reduced income would have been spent on life-saving or health-enhancing activities. Hence the taxation actually increases life risks. HHA compares the anticipated saving in lives from a policy with the lives lost because of the cost of the policy. In principle, policies costing more lives than they save are not desirable. HHA proceeds by estimating the costs of a life-saving policy and the number of lives saved. It then allocates the policy costs to households. Life risks are related to household incomes through regression analysis, so that it is possible to estimate lives lost due to income reductions. Once again, the procedure is not comprehensive: policies could fail an HHA test but pass a CBA test, and vice versa.

Cost-effectiveness analysis (CEA)

The easiest way to think about CEA is to assume that there is a single indicator of effectiveness, E, and this is to be compared to a cost of C. Suppose there is now just a single project or policy to be appraised. CEA would require that E be compared to C. The usual procedure is to produce a cost-effectiveness ratio (CER). Notice that E is in some environmental unit and C is in money units. The fact that they are in different

units has an important implication which is, unfortunately, widely disregarded in the literature. A moment's inspection shows that the ratio is perfectly meaningful– e.g. it might be read as US dollars per hectare of land conserved. But the ratio says nothing at all as to whether the conservation policy in question is worth undertaking. In other words, CEA cannot help with the issue of whether or not to undertake any conservation. It should be immediately obvious that this question cannot be answered unless E and C are in the same units. CEA can only offer guidance on which of several alternative policies (or projects) to select, given that one has to select one. By extension, CEA can rank any set of policies, all of which could be undertaken, but given that at least some of them must be undertaken.

A further issue with CEA is the process of selecting the effectiveness measure. In CBA the principle is that benefits are measured by individuals' preferences as revealed by their willingness to pay for them. The underlying value judgement in CBA is "consumer" or "citizen sovereignty". This amounts to saying that individuals are the best judges of their own well-being. Technically, the same value judgement could be used in CEA, i.e. the measure of effectiveness could be based on some attitude survey of a random sample of individuals. In practice, CEA tends to proceed with indicators of effectiveness chosen by experts. Rationales for using expert choices are a) that experts are better informed than individuals, especially on issues such as habitat conservation, landscape, etc., and b) that securing indicators from experts is quicker and cheaper than eliciting individuals' attitudes.

Multicriteria analysis (MCA)

MCA involves multiple indicators of effectiveness, and is one of the more widely used means of selecting among very different alternatives faced by decision-makers. In MCA, different effectiveness indicators, measured in different units, have to be normalised by converting them to scores and then aggregated via a weighting procedure. Policy or scheme cost in an MCA is always (or should always be) one of the indicators chosen. The steps in an MCA are as follows:

- The goals or objectives of the policy or investment are stated.
- These objectives are not pre-ordained, nor are they singular (as they are in CBA which adopts increases in economic efficiency as the primary objective) and are selected by "decision-makers".
- Generally, decision-makers will be civil servants whose choices can be argued to reflect political concerns.
- MCA then tends to work with experts' preferences. Public preferences may or may not be involved.
- "Criteria" or, sometimes, "attributes" which help achieve the objectives are then selected. Sometimes, objectives and criteria tend to be fused, making the distinction difficult to observe. However, criteria will generally be those features of a good that achieve the objective.
- Such criteria may or may not be measured in monetary terms, but MCA differs from CBA in that not all criteria will be monetised.
- Each option (alternative means of securing the objective) is then given a score and a weight. Pursuing the above example, a policy might score 6 out of 10 for one effect, 2 out of 10 for another effect, and 7 out of 10 for yet another. In turn, experts may regard the first effect as being twice as important as the second but only half as important as the third. The weights would then be 2, 1 and 4 respectively.
- In the simplest of MCAs, the final outcome is a weighted average of the scores, with the option providing the highest weighted score being the one that is "best". More sophisticated techniques might be used for more complex decisions.

- To overcome issues relating to the need for criteria to be independent of each other (i.e. experts' preferences based on one criterion should be independent of their preferences for that option based on another criterion), more sophisticated techniques might be used, notably "multiattribute utility theory" (MAUT). MAUT tends to be over-sophisticated for most practical decision-making.

APPENDIX 6.3
FAO indicators for sustainable development of capture fisheries

Ecological criteria

Catch structure catch structure refers to the size of fish, species composition and numbers, and the trophic level of each species in the catch. Shifts in the catch structure are strong signals of potential non-sustainability in the fishery.

Area and quality of important or critical habitats critical habitats (e.g. Mangrove systems or coral reefs) provide critical and direct support for fisheries production and are important for biodiversity in general and as source of food for exploited species. Change in the area of habitat, as measured using habitat inventory tools, can indicate changing conditions in the environment that could be caused by fishing, or might affect fishing activities.

Fishing pressure - fished vs. Unfished areas not all areas within any given fishing grounds are fished with equal intensity as fishing grounds are not usually considered to be homogeneously productive. Thus some areas will be more intensively fished because of a greater perceived return or catch rate. In addition, reserves etc. are used to protect spawning stocks, or sensitive young life stages from harvesting or other detrimental effects.

Economic criteria

Profitability in the absence of major market distortions such as extensive subsidies or the existence of price controls, profitability is the single most important economic criteria. Low or negative profitability usually indicates that fish stocks are exploited in an economic wasteful manner and fishing capacity and effort are excessive on both economic and biological grounds.

Value of fishing entitlements where management is done through transferable entitlements such as individual transferable quotas, the resource rent becomes capitalized in the value of the entitlement. In theory, the entitlement is worth the sum of the discounted stream of future profits or rent (i.e. The net present value). In the absence of speculative trading, a change in the market price of quota entitlement, thus, reflects a change in the, by market participants, estimated profit potential of the fishery. Such a change can occur as a result of a decline in stock abundance, a drop in fish prices or an increase in fishing costs.

Subsidies apart from failing to effectively regulate access to the fishery, the single most important cause for economic waste and overfishing is the provision of subsidies for fishing inputs such as for fuel and for the construction and purchase of fishing vessels and gear.

Social criteria

Employment changes in the total amount of paid labour or employment in a fishery can be an indicator of both the condition of a fishery and its value to the local populations that may be dependent on fisheries for their livelihood.

Protein consumption change in per capita fish consumption, and fish consumption as a proportion of total protein consumption, are important criteria that relate to the significance of the contribution of fisheries to the livelihood of coastal communities, and can be related to the community pressure for sustainable development of fisheries.

Tradition and culture the loss of traditional practices can indicate substantial changes in fishing practices, and may signal the loss of traditional fisheries management systems and reduced controls in loosely organized and subsistence fisheries.

Governance/institutional criteria

Capacity to manage the capacity to manage fisheries depends on available human and financial resources as well as on the existence of competent institutions. An economically sound fishery should make acceptable returns on investments after the costs of management are accounted for. In many fisheries, however, returns are marginal or negative and, as a consequence, the costs of management are considered to be an extra burden. Fisheries management also requires an adequate institutional base, including a set of regulations and a system to generate and enforce them.

Compliance regime compliance regimes assess the extent to which the rules designed to keep fisheries sustainable are applied in practice. The existence and effectiveness of compliance assessment regimes can be evaluated by examination of fisheries management plans and, in subsistence fisheries, examination of traditional practices.

Transparency and participation fisheries managed exclusively by "top-down" approaches are found to be at high risk of non-sustainability. Transparency and participation do not guarantee sustainability, but fisheries are unlikely to achieve sustainability without them. Transparency and participation can be evaluated by assessment of the fishery's management plan, particularly in the structural and functional elements that permit effective participation of fishers in the decision-making process.

7. Incentive mechanisms for applying EAF

INTRODUCTION

The previous chapter discussed the range of benefits and costs involved in implementing the EAF. It was noted that these benefits and costs arise over varying time frames – some in the short-term, some only after considerable time has passed – and at various scales (e.g. local, regional, national, international), impacting in differing ways on the many individuals and entities within the fishery – thus having significant distributional implications. These realities lead to a challenge in implementing the EAF, namely that not all participants will necessarily see the prospect of receiving positive net benefits from EAF management (in the short term, at least). There is, in other words, a gap between the shifts in behaviour needed for full EAF implementation, and what can be expected to occur "naturally" simply as a result of individuals pursuing their own self-interest as driven by the set of EAF benefits and costs.

There will be a need for additional measures of various sorts to induce fishery participants (and others) to change behaviour in keeping with EAF management. Such measures supporting positive behavioural change could be socio-cultural, economic, legal or institutional in nature. This chapter reviews a range of such measures, all of which involve the use of "incentives" towards behavioural change, i.e. considerations that an individual will factor into their decision making and which lead to a result more in keeping with desired societal directions (in this case, effective implementation of EAF).

As FAO (2005a) notes: "Incentives work indirectly through affecting those factors that lead to particular individual or collective choices…". From an economics perspective, one might view an incentive as an influence on the profit-maximization of a fishery participant (i.e., increasing profits for EAF-compatible actions and conversely), while from a sociological perspective, incentives might be social constraints on behaviour (e.g. resulting from peer pressure and cultural institutions).

Often those speaking of incentives are implicitly referring to "positive incentives", i.e. those that reward participants (perhaps by giving them something, such as fishing rights) rather than negative incentives which penalize them (e.g. with fines for undesirable behaviour). In reality, however, both of these forms are incentives to modify behaviour. From the perspective of EAF implementation, then, a key requirement is to determine which set of incentives provides the most effective results with the least negative impacts.

The above has provided general motivation for the role of incentives – and indeed the full range of social, economic and institutional measures – in inducing behaviour in support of EAF objectives. But what exactly are these measures seeking to achieve? What behaviour is it that needs to be modified? First, looking broadly at the fishery reality, a key element is to encourage a longer-term view, placing greater value on ecosystem health and sustainability of fish stocks. This may require certain forms of incentives, such as use rights, management rights or community stewardship actions, to increase the possibility that participants choose to engage in long-term conservation. Second, there is a need for modifications to specific behaviour – e.g. to reduce dumping, discarding and high-grading of fish, or to restrict fishing gear that is particularly damaging to aquatic ecosystems. Incentives to achieve such ends may need

to be carefully targeted on specific situations and specific participants. Overall, then, we can envision an "incentives toolkit" from which appropriate incentives are drawn to meet specific requirements.

As noted above, incentives are often classified as "positive" or "negative"("disincent ives"). These may also be considered as "carrots" and "sticks", with the "carrots" being positive incentives that induce desired behaviour (just as a carrot hanging in front of a horse can induce it to move forward) and the "sticks" being disincentives in the form of penalties for undesirable behaviour (a stick being used on a horse that will not move in the desired direction). The major focus of conventional natural resource management has been on establishing sets of regulations, with penalties ("sticks") imposed for non-compliance with the regulations, i.e. for illegal activities. This is a similar situation to that of pollution regulation, in which polluters are penalized, if caught, for exceeding prescribed levels of pollutants.

However, in a fishery context, with a large number of participants, ranging over large areas, apprehending the rule-breakers (i.e. creating adequate enforcement of the disincentives) has proven a challenge. This reality has led to a recognition that the use of "sticks" needs to be balanced with greater use of "carrots", the positive incentives inducing desired behaviour, in the hope that the need to find and punish rule-breakers will diminish. Indeed, it has been suggested that suitable incentives will provide "fishers with the incentives and the mandate to be co-custodians, with other stakeholders, of the marine environment" (Grafton *et al*., 2005).

On the other hand, the trend towards the use of positive incentives has created a risk of over-reliance on such measures, just as in the past there was an over-reliance on disincentives ("sticks"). The theory of crime and punishment indicates clearly that no matter how rules or regulations are formed, there will always be a certain proportion of those subject to the rules and regulations who do not comply with them. It is important to the integrity of the entire management system, and the continuing support of law-abiding participants, that these rule-breakers be apprehended and punished as much as possible. Thus, despite the difficulties noted above with enforcement of negative incentives, suitable "sticks" are crucial.

Note that the need for a balance of both "carrots" and "sticks" holds whether one is dealing with a centralized or a decentralized fishery management system. Indeed, law-abiding fishers in a co-management arrangement, those involved in their own self-regulation, are the first to call for strict enforcement of rules, and large penalties for rule-breakers. It is thus important to seek out an appropriate balance in a context-sensitive manner. As FAO (2005a) notes: "Making better use of incentives, in conjunction with appropriate enforcement systems, could help to improve compliance and regulation."

This chapter will thus discuss both the "carrots" – positive incentives for shifting fisheries towards EAF – and the "sticks" in the form of disincentives. The following section briefly reviews options for financial, social, and institutional incentives in the application of EAF management, while the subsequent section focuses on the economic analysis of some specific incentives.

TYPES OF INCENTIVES AND THEIR EAF IMPLICATIONS

The EAF Guidelines touch on some measures to align incentives in support of EAF – such as improving the institutional framework, developing collective values, and creating and using market and non-market incentives. The idea of measures to "align incentives" is to provide a more efficient alternative to conventional top-down "command and control" approaches to fisheries management. The latter have had limited success in meeting sustainable development objectives, due to a range of factors including insufficient information about the resources, inadequate control efforts,

and lack of political will[38]. Ward *et al.* (2004) discuss the desirability of shifting the focus from conventional "incentive blocking instruments" towards more "incentive adjusting instruments".

This section furthers the coverage of incentives in the EAF Guidelines by discussing social, economic, legal and institutional incentives that may help explain what drives individual and group behaviour. With this understanding comes further knowledge on what policy and management tools could be used as incentives to induce fishery participants to adopt specific EAF-appropriate measures, or more generally to support implementation of EAF management. Some specific examples of possible incentives may include:

- providing educational programs, for adults and for children, to raise awareness of the role of healthy ecosystems in supporting fisheries, and the impacts of fishing and other human activities on those ecosystems;
- developing legal frameworks and participatory governance arrangements (co-management) that involve stakeholders in developing regulations for fishery management, and EAF in particular, thus building support ("buy-in") for that management;
- providing secure access rights to fishery participants, so their decisions will be made on a longer-term basis rather than in a situation in which future access is uncertain;
- developing positive economic incentives to make behaviour in accordance with EAF more profitable (i.e. to increase benefits or decrease costs of EAF implementation); and
- imposing disincentives against illegal behaviour, in the form of appropriate penalties (e.g. monetary fines, social exclusion or imprisonment) along with effective enforcement.

From this range of possibilities, we see that incentive systems can involve:

- **Institutional incentives** (e.g. fisheries management systems and participatory governance arrangements that induce support from stakeholders);
- **Legal incentives** (e.g. effective legislation creating positive "carrots" as well as "sticks" in the form of significant penalty structures with effective enforcement capability);
- **Financial/material incentives** (e.g. win-win measures, such as the use of excluder devices in fishing gear, which can actually increase profits, by reducing fishing costs, even as they meet the goal of reducing bycatch); and
- **Social incentives** (e.g. community-based institutions and social environments that create peer pressure on individuals to comply with agreed-upon community rules).

It is clear that incentives can take many forms – some being of quite general applicability, and others being very specific to particular circumstances. For the remainder of this chapter, we focus on the commonly-advocated approaches for creating incentives supportive of policy goals, such as EAF, clustered into the four incentive systems mentioned above.

Institutional incentives

Institutional failures have been pointed out as the main obstacles to effective fisheries management. In particular, rather than limited biological knowledge being the major reason behind the lack of implementation of EAF management or the failure to achieve management objectives, more important are institutional causes such as: low levels of compliance due to limited legitimacy of the management process and objectives,

[38] See, for example, Kompas and Gooday (2007), Grafton *et al.* (2005), and Ward *et al.* (2004).

conflicts that have not been mediated or resolved, lack of enforcement mechanisms in place, inadequate institutional set-up for management due to it having been imported from a different context, etc. (Degnbol, 2004). On the flip side, an institution that promotes transparency, cooperation, trust, and participation on the part of stakeholders can help create the incentives necessary for application of the EAF.

This section reflects on some of the ways that proper institutional arrangements can promote sustainable use of resources through the holistic, integrated, and participatory application of the EAF. Mechanisms discussed here include coordination and integration of planning and management, devolution of decision-making and management responsibility, conflict resolution, knowledge management, monitoring and control, education, stakeholder involvement, capacity building, and use and management rights. Most of these are in fact relevant to any form of management, although some are especially necessary in the face of the increased complexities, uncertainties, stakeholder groups implied within the EAF.

Increased coordination, cooperation and communication between relevant institutions

Due to its wider scope of management, the ecosystem approach requires increased coordination, cooperation and communication between relevant sectors (agriculture, tourism, commercial- and non-commercial fisheries, communities etc.) and regulatory institutions (ministries, etc.), on and between regional, national and sub-national/community levels, in order to manage fisheries effectively.

Increased cooperation is needed because the increased management scope requires more assistance from every institution, stakeholder and use sector. There also needs to be coordination between, and clarity of, the responsibilities of each player in the process (e.g. information gathering, research, management, law enforcement) in order to ensure coherency in management of the resources, and improved efficiency in the application of such management.

At a regional level, one factor that increases the need for coordination and cooperation between sectors and other institutions is the disparity between ecosystem and jurisdictional boundaries (such as exclusive economic zones [EEZ]). Not only does this require intersectoral and institutional coordination and cooperation nationally but also internationally.

Flexibility in the cooperation and coordination is also needed as ecosystem boundaries (e.g. those of a large marine ecosystem [LME]) may vary seasonally and annually, requiring flexibility in agreements between relevant agencies and nations (EAF Guidelines).

As the development and implementation of EAF policy and legislation will often be undertaken by the national fisheries department or designated management agencies at a national level, and by regional fisheries management organizations at the regional level, these institutions will need to cooperate and coordinate their work (EAF Guidelines).

At a sub-national level, it has been suggested that devolution of decision-making and management responsibility to organizations or groups lower than the central national level, for example to coastal communities, may improve compliance, improve the cost-effectiveness of management and make use of traditional management practices. A decentralization of management responsibility will, however, need to account for ecosystem boundaries which perhaps will require intercommunity coordination and cross-scale linkages (EAF Guidelines).

Increased information and managing uncertainties in the decision-making process

Moving from conventional fisheries management to EAF management requires more information not only on species interactions, critical habitats, etc., but also on how

different sectors and stakeholders benefit from and impact on ecosystem services. This information will aid in the process of taking decisions on the most appropriate management measures and use of resources within a multiobjective context, but it may also assist in raising awareness of the need for management among the public at large and at a community level. Information thus needs to be gathered and disseminated at all relevant levels of governance.

In addition, a desire to incorporate a broader range of ecosystem factors into the management process, in the absence of a complete information set, will require the ability to manage resources within a context of increased uncertainty. Hence, the management framework will need to acknowledge these uncertainties and incorporate them into the decision-making process.

Increased stakeholder involvement

As an increased scope of management of the sort needed in the EAF, requires a broadened definition of stakeholders, mechanisms will be needed to allow for this range of stakeholders to be included in the management process, to improve the effectiveness of EAF.

The benefits of increased stakeholder involvement are numerous and include the following, as presented in FAO (1995c):

- ensuring that alternatives serving a broad range of interests are considered;
- helping to gather data or information, identify gaps in data or information, and identify those who might provide data or information in the future;
- providing transparency and accountability regarding the decisions taken and the process by which those decisions were reached;
- accustoming stakeholders to the need for difficult choices in order to manage aquatic resources effectively; and
- building a broad base of commitment to chosen options, by creating an environment that rewards participation in discussions of benefits, risks and costs of the various options, and that provides a meaningful basis for informed consent to recommendations.

However, it is important to realize that a participatory approach may lead to higher costs of management. These can stem from, for example, an increase in the number of meetings held during the planning process and a more developed information dissemination effort. In addition, an increased number of stakeholders means an increased number of objectives and interests to be balanced. In order to reconcile multiple objectives/interests, mechanisms for conflict resolution may be necessary.

Institutional mechanisms for facilitating the implementation of the EAF

In facing the above-noted additional challenges to be addressed institutionally in the move towards EAF management, what mechanisms can be used, or what changes can be made to existing frameworks in order to address these issues? Some of these are considered here.

Coordination and integration

To address the need to increase coordination and integration, through suitable strategies at the various different levels of governance, Scialabba (1998) distinguishes two broad institutional set-ups for increased coordination and integration:

1. Multisectoral integration involves translating common goals into independent sectoral planning. This can be done by coordinating the institutions, sectors and/or agencies that are actually in charge of managing fisheries and/or multisectoral uses of the ecosystem, through a common policy. It can also occur by bringing related stakeholders, institutions and/or sectors together to agree on strategies for working towards common goals.

2. Systematic integration likely implies that a new, integrated institutional structure is created, in keeping with the broad systems approach of EAF (and of the larger framework of integrated management within which EAF may be embedded). Suitable management, development and policy initiatives are then placed within this new institutional framework.

The second of these has a logical appeal, in reflecting a comprehensive response to the comprehensive challenge of an ecosystem approach. However, at a national level, one is faced with a number of agencies each with its own mandate – notably, it may often be the case that the Fisheries authorities will take the lead role in EAF implementation. Given this multiplicity of agencies involved, it may be more straightforward to coordinate the work between the existing institutions or ministries (i.e. multisectoral integration), rather than setting up a new institutional framework within which management, policy and development functions are integrated through broad administrative responsibilities that overlap the traditional areas of responsibilities of certain ministries. A choice to working within existing frameworks (multisectoral integration) also reflects the fact that line ministries may be reluctant to accept changes in their core responsibilities, for fear of the financial ramifications and perceived power shifts within the system (Scialabba, 1998).

As an additional note, it is important to mention that when functioning traditional institutions exist on a community level, and are regulating exploitation of fisheries resources, there should be a focus on strengthening such mechanisms instead of introducing new ones (FAO, 1998). The idea here is that if the existing mechanisms are already respected and well-functioning, there is no need to introduce new and unfamiliar mechanisms, as these may be less effective and indeed counter-productive.

In situations where it is deemed preferable to coordinate actions, activities and responsibilities within an existing multifaceted framework rather than integrating into a single institution, what would be required for creating effective coordination? Scialabba (1998) has suggested some prerequisites:

- adoption of a holistic approach to governance;
- agreement on goals and policies at the national, sub-national and sector levels;
- agreement on respective roles, jurisdictional boundaries, provision of resources and responsibilities at different levels of governance; and
- provision for effective negotiation (bargaining) between different levels of governance, between these and the line ministries, between ministries, and between government and civil society groups that use and manage aquatic resources.

In order to promote more effective coordination, a well-defined communication strategy will be necessary. Scialabba (1998) also suggested some examples of ways of improving communication between relevant sectors, institutions and/or stakeholders:

- information sharing and transfer;
- joint education and training, when appropriate;
- joint assessment and acceptance of costs and benefits of environmental changes and proposed policy interventions, when appropriate;
- learning from policy experience;
- joint project and policy monitoring and evaluation;
- participation by all stakeholders; and
- balance between top-down and bottom-up processes.

Devolution of decision-making and management responsibility

As noted above, devolution of decision-making and management responsibility to institutions or groups lower than the central national level (e.g. to coastal and riparian communities) has been proposed as potentially effective given the right circumstances. However, this requires that (1) management decisions and actions are coordinated and consistent at higher levels, in order to make EAF management effective (EAF Guidelines),

and (2) such administrative changes are accompanied by capacity-building among local decision-makers (FAO, 1998), as well as other human and financial mechanisms.

In addition, moves to more devolved management may need to deal with problems related to existing local structures. For example, situations could arise in which local-level institutions are dominated by members of a certain social or economic group, who may or may not fully represent the interests of all those likely to be affected by a change in fisheries management. Therefore, it is important that local institutions and stakeholder representatives responsible for fisheries management are trusted and respected by all stakeholders, especially in cases of decisions regarding the distribution of compensation and access to resources (FAO, 1998).

Conflict resolution

Establishing mechanisms for conflict resolution can be important in stakeholder involvement processes, by aiding in the reconciliation of multiple objectives. Administrative procedures and dispute resolution offices may be formal ways of anticipating and resolving conflicts between and within institutions.

Also at a local level, traditional/religious institutions (e.g. customary courts and assemblies) may provide appropriate and respected conflict resolution mechanisms for certain kinds of disputes. However, in terms of dealing with resource distribution and control, the appropriateness of such institutions will depend on the extent to which the authorities of such tribunals are seen as representative and independent, without vested interests or influence by a certain group of the community (FAO, 1998). Understanding of local institutions and cultures is a necessary ingredient in the development of devolved management processes.

Whatever structure is used at a local or community level, additional funding may be required for conflict resolution (Scialabba, 1998). This would be needed to cover the costs of:

- building up local capacity for conflict resolution, by training and educating third parties for mediation, facilitation and arbitration in disputes; and
- carrying out the negotiations, including locating mediators or experts – potentially external if local expertise is lacking.

Knowledge management

In applying the EAF, it is clear that more and/or different information will be needed to assist the decision-making process. Managing a more complex system, with interactions between an increased number of stakeholders and also between components of the ecosystem itself, conveys a need for a new dimension of knowledge that goes beyond focusing solely on natural science and technology. In addition to the need/desire for increased knowledge of this complex system, there will also be an increased need for dealing with uncertainty in the decision-making process. A good deal of this information may be supplied by existing research institutions; however, research may not be sufficient to solve all issues of uncertainty or, additional research may come at too high a cost. In these cases, the best available information should be used, implying both scientific research as well as the use of traditional knowledge. In the case where uncertainty still exists, this knowledge gap would have to be dealt with through the decision-making process (Degnbol, 2002).

To further this point, Degnbol (2004) suggests that, ultimately, there will be economic limitations if the requirements for understanding, precision and implementation efficiency are to be maintained, while the complexity of issues to be addressed increases as well as the number of stakeholders involved. Given the complexity of the systems to be managed, it is thus not feasible to depend on a management approach based solely on quantifiable predictability, but rather, there is a need to accept an approach based on weak predictability and adaptation.

Using indicators rather than assessments based on complex models of processes, for example, allows for low-cost observations reflecting features of the ecosystem, which can be recognized and accepted by fishermen, scientists and other stakeholders. Indicators that represent ecosystem health may inform the decision-making process of management, without pretending to grasp all details or capture all possible outcomes. Ideally, indicators can summarise the outcome of complex, underlying processes which may not be fully understood. In identifying indicators of local relevance, the use of indigenous knowledge is essential (Degnbol, 2004).

In the Framework for Action of the UNESCO/ICSU World Conference on Science for the Twenty-first Century (in ACFR, 2000), the importance of traditional knowledge systems is stressed, not only because they harbour information as yet unknown to modern science, but also because they are expressions of other ways of living in the world, other relationships between society and nature, and other approaches to the acquisition and construction of knowledge. Linking science with other knowledge systems is likely to inform both sides. On the other hand, Campbell and Salagrama (2000) (in ACFR, 2000) suggest that, since the size and scale of many social and environmental problems have increased vastly, using indigenous knowledge in local areas, in isolation from the outside world, is often inadequate to cope with these new challenges. This implies a need to generate new knowledge as well.

Different sources of knowledge for management may have institutional implications – for example, management decisions may have less legitimacy if the knowledge base is not shared among stakeholders. Overall, the knowledge base needs to be relevant to the local context and it has to be considered valid by stakeholders (Degnbol, 2004).

Public education

In order to understand why it is important to use an ecosystem approach to fisheries and what this entails, it is imperative to inform and educate not only the fishermen and those involved in the production system, but also the public in general and the local communities, through some system of public education.

Education for stakeholders in fisheries and aquatic ecosystems leads to a greater understanding of the needed measures and changes in resource use, and this – in combination with participatory approaches to management – can lead to a greater willingness to adjust and comply with new rules and regulations. Informing the general public could, as well as increasing the understanding for the need for such an approach, also help increase general support and add an inducement to the fisheries industry/sector to implement EAF changes.

Public participation/stakeholder involvement

In order to attain the holistic and integrated approach which the EAF is supposed to represent, public participation and stakeholder involvement are essential. Although there are several levels of public participation, from minimal information sharing (dissemination of information to affected or interested groups), through consultation (feedback sought from affected or interested groups prior to decision-making), to participation by multiple stakeholders in the actual decision-making process, the EAF promotes as great a level of participation as possible. As participatory methods can help achieve reconciliation of multiple objectives; exchange of knowledge; and increase of understanding (Scialabba, 1998), they are important tools in legitimising the EAF management system among stakeholders.

Stakeholder involvement can also take many forms, such as shared decision-making (consensus building), collaborative decision-making (co-partnerships), and empowerment (self-management) (Scialabba, 1998). Essentially this is related closely to co-management – the participation of communities/resource users together with

governmental institutions in sharing decision-making, planning and implementation roles. Co-management was discussed as a policy framework in Chapter 3.

EAF management can incorporate all of these forms of participation, perhaps in different forms for different contexts. Shared decision-making should help in the application of agreed-upon management plans, as acceptance will have been fostered through the participation process. However, naturally, it will be difficult to achieve consensus among an increased number and variety of stakeholders; therefore, it is important to allow sufficient time for a participatory process to work properly, likely more time than in top-down management systems.

Examples exist in which stakeholders, including the fishing industry, have led the promotion of change, such as through creating "best practice" guidelines, and this kind of leadership may prove to be an important factor in the application of the EAF.

From an institutional perspective, FAO (2005a) has identified that successful co-management requires not only empowerment of the community/ies through devolution of power to a local level, but also:

- Effective institutions, particularly local institutions – e.g. who facilitates the process and the scale of the process, i.e. what should really be addressed under co-management.
- Adequate resources for implementation, since participation in meetings, monitoring, enforcement and management involve costs which can be high.
- An enabling policy and legislative environment, including a robust enforcement mechanism and sanctions system to ensure compliance with locally agreed rules.

An example of the institutional set-up of co-management within one multisectoral example is presented in Box 12.

Communities and other resource users are to a certain extent empowered by becoming co-managers of resources, yet further strengthening of their organizations and capacity enhancement is required for a successful continuation of this co-management (Kumar, 2005). Empowerment requires both interventions at the community level and outside the community:

- Interventions at the community level include increasing the sense of unity through improved organization, assistance in capacity development, etc.
- More broadly, community organizations can be involved in networking at village, local, regional and national levels.
- At a governmental level, work can be done to create an enabling environment by providing conducive policies, and a legal and regulatory framework, etc.

In co-management as well as in the empowerment process, it is important to recognize the fact that women and youth tend to be underrepresented in traditional institutions and decision-making mechanisms for dealing with natural resource use. However, such decisions still affect these groups (FAO, 1998).

Monitoring, control and surveillance

Only in the recent past has monitoring, control and surveillance (MCS) been recognized as an integral part of fisheries management and not merely a police function to punish law breakers. MCS is now being recognized not only for its role in protecting fisheries from IIU fishing, both national and international, but also for its role in providing necessary biological, economic, and social information for management and as a means to provide a backbone to management implementation. In fact, without MCS, there can be no certainty that pre-determined management objectives will be realized. For simplicity, MCS has been described by its three components (Flewwelling, 1995):

- *Monitoring* fishing activities, notably fishing effort characteristics and resource yields;
- *Control* over the regulatory conditions under which the exploitation of the resource may be conducted; and

BOX 12

West Coast Vancouver Island Aquatic Management Board

In a move to develop an integrated and participatory approach to the management of coastal activities affecting marine resources on the West Coast of Vancouver Island (WCVI), in British Columbia, Canada, an initiative in community-based co-management began in 2001. Approval by multiple levels of government of the terms of reference for the regional Aquatic Management Board was seen as an important step forward. These Terms of Reference (ToR) state that the aquatic resources should be managed on an ecosystem basis.

The Board functions as a forum for shared decision-making - in which "those with authority to make decisions, and those who will be affected by that decision, will jointly seek an outcome which reconciles/accommodates all interests concerned". On the Board, coastal communities and others affected by aquatic resource management can work with governments in matters of integrated management of aquatic resources in relevant management areas.

The Board consists of 16 members – eight from governments and eight non-governmental. The former include two representatives each from the federal, provincial, regional and aboriginal (indigenous) governments. The non-governmental representatives reflect a diversity of geographical locations and resource interests in the management area. The Board members are to be appointed on the basis of the Board's vision and purpose, their skills, knowledge and experience, and base of support, rather than to represent individual groups or organizations.

Some of the principles mentioned in the ToR are as follows:

- Shared Responsibility – the governments, coastal communities, and other stakeholders affected by the use of the aquatic resources are jointly responsible and accountable for integrated resource management.
- Inclusivity – coastal communities and others affected by the resource management should have the opportunity to participate in the formulation and implementation of management decisions.
- Flexibility – administrative structures and processes should be flexible and expected to evolve in order to accommodate the continuous management process.

Some of the key objectives are to:

- consolidate information relating to different aquatic resource uses and utilization to provide a holistic picture of the health of ecosystems within the management area;
- integrate expertise and knowledge from First Nations (indigenous people/tribe), local, scientific, and other sources;
- ensure opportunities for coastal communities and others affected by the resource management to participate in all aspects of integrated management, protection and restoration of aquatic resources.

The Board has been operating for several years and received a positive review from a recent independent assessment body (see Pinkerton *et al.*, 2005). For more information, visit the Board's website: http://www.westcoastaquatic.ca

- *Surveillance* – the specifics of observations required to maintain compliance with the regulatory controls imposed on fishing activities.

There are two parallel approaches to effective MCS – one is the preventive approach of compliance measures, and the other is the deterrent/enforcement approach. The first approach includes (adapted from Flewwelling *et al.*, 2002):

– enhancement of community/fisher awareness and understanding of management practices and MCS through seminars, public awareness and information, education, and communication campaigns;

– participatory management development to promote ownership of the management regime and input into the regulatory/control aspect of management (laws and regulations) in preparation for acceptance by the fishers of their joint "stewardship" role for the management of their fisheries in partnership with government;
– peer pressure towards voluntary compliance and support for the management regime;
– the institution of accurate and verifiable data collection regimes; and
– surveillance and verification for compliance.

On the other hand, the deterrent/enforcement approach, seeks to ensure compliance by fishers who resist the regulatory regime. This approach includes inspection, investigation, prevention and court proceedings to enforce the law. It is a necessary complementary approach to that of voluntary compliance, which would fail if stakeholders see non-compliant fishers successfully evading the law and receiving economic returns from their illegal activity, at the expense of the fishers who comply (Flewwelling *et al*., 2002).

In establishing and operating an MCS system, in addition to infrastructure and equipment costs, those on the human side include (Kelleher, 2002):

- Development of institutions and human resources, which often includes coordination among institutions responsible for MCS at the national (or international) level, and practical training of fisheries inspectors and operational personnel;
- Personnel – in general terms it can be said that the higher the incomes in a country, the greater will be the proportion of the recurrent MCS costs attributable to staff;
- Administration and coordination – the administrative costs of MCS are difficult to isolate from those of other administrative tasks, as they are closely intertwined; and
- Costs to fishermen – a restriction on a fisherman's activities incurs a cost. If the costs of compliance are high, the risk of violation is also high.

In order to achieve an effective MCS system, one must bear the following findings in mind (Flewwelling *et al.*, 2002):

- Each MCS system must be adapted to the cultural, geographic, political and legal framework of the state or region concerned as there are no universally applicable models;
- An absolute requirement for a successful MCS system is political will of the state, or strong national government support of a regional body;
- The operational character of the system will depend on management decisions;
- When establishing an MCS system, legal and policy considerations must always be taken into account;
- National and regional MCS activities must complement each other; and
- Stakeholder involvement is key to successful implementation of management and MCS plans.

In terms of legislation, an MCS system needs to be based on clear legal rules that set out the rights and responsibilities of the various parties, in order to be effective. These rules should provide effective and efficient legal procedures and mechanisms for implementing those rules consistently. It is therefore important to review the existing domestic legislation to ensure that it prescribes norms that are appropriate to achieve the desired fisheries management objectives and contains provisions that facilitate effective enforcement (Flewwelling *et al*., 2002). As a part of the coordination process, there needs to be an agreement on who is responsible for what (e.g. jurisdictional boundaries) – i.e. what roles different institutions should have (Scialabba, 1998).

In general, strengthening a national MCS regime will involve addressing the following key issues:

a) ensuring that fisheries administrators and enforcement officers can exercise all powers available to coastal, port and flag States under international law (this will usually require reviewing the powers of enforcement officers under domestic law and strengthening procedures under which the States grants authorization to fish);
b) increasing regional and international cooperation in order to reduce the incidence of IUU fishing, including measures to support the enforcement of fisheries conservation and management measures on the high seas and in areas under the jurisdiction of other States;
c) increasing the transparency of fishing efforts by improving monitoring programs (particularly by requiring the use of VMS);
d) facilitating the use of information derived from monitoring and surveillance (particularly from new VMS technologies) to promote compliance; and
e) strengthening existing sanctions and extending the range of compliance mechanisms available to enforcement officers (adapted from Flewwelling *et al*., 2002).

In order to attain a cost-effective MCS system, the cooperation of the fishing industry and fishers is essential. Lack of participation in fisheries management, including MCS planning and implementation exercises, may often result in non-compliance. It is thus vital that stakeholders are involved in the development of acceptable, responsible and sustainable management planning and implementation. Involved stakeholders will not only know and understand the rules and the rationale for their development, but will also be more inclined to comply with them voluntarily. This may increase or even reduce the costs of the MCS, whilst simultaneously increasing its effectiveness (Flewwelling *et al*., 2002; Gitonga, undated).

Capacity-building

As mentioned throughout this document, the EAF will require a more holistic and integrated way of thinking about fisheries management, in order to take into consideration the multiple needs and desires of societies, beyond conventional fishery aspects. It will thus also require increased stakeholder involvement/participation in order to achieve this "new" way of thinking, and setting economic and social objectives. Within the institutional framework, capacity-building may be required in relation to:

- Improved institutional linkages within the fisheries management system: capacity is needed particularly to build the ecosystem-wide and cross-sectoral skills and experience needed to smooth the way towards applying a holistic and participatory approach to fisheries management (Scialabba, 1998).
- Participation: capacity building is needed both to facilitate such a process (mediation, negotiation, conflict resolution, etc.) and in order for the participants to have sufficient information/training to be able to participate in a meaningful way.
- Monitoring, Control and Surveillance.
- Research: the capacity is needed to undertake new areas for research, such as cross-sectoral disciplines.

In addition, there are the requirements of capacity development in certain technical areas that require more emphasis on understanding ecosystem structures, habitat restoration methods, marine protected areas, and measures to deal with bycatch reduction, etc. (Macfadyen and Huntington, 2003).

Institutions involved in fisheries management, both in industrialized and developing countries, may therefore need to change to allow for these new requirements. However, it is not simply about adjusting institutions according to new needs – equally important is building/developing capacity to handle these new requirements. Capacity must be developed to translate the underlying principles of EAF management into policy goals

and then into operational objectives that can be achieved by applying management measures (Macfadyen and Huntington, 2003).

Capacity development has been defined as "the process by which individuals, groups, organizations, institutions, and societies develop their abilities – both individually and collectively – to set and achieve objectives, perform functions, solve problems and to develop the means and conditions required to enable this process" (UNDP, 1997, in Macfadyen and Huntington, 2003). This definition highlights two important features of capacity development: Firstly, this is a process and not a passive state – individual development becomes a part of a sustainable shift in performance and collective behaviour (Macfadyen and Huntington, 2003). Secondly, there are thus four levels at which capacity development can take place. These are: in individuals, in organizations/institutions, in sectors and networks, and in the overall environment in which the first three function (Macfadyen and Huntington, 2003):

- At the *individual level*, the focus is on enabling individuals to embark on a continuous process of learning, building on existing knowledge and skills, and extending these in new directions (Fukuda-Parr *et al.* 2001). This level refers to the individuals operating within the other three levels, or being affected by them.
- At the *sector/network* level, there is a need for coherent sector policies and strategies, as well as co-ordination across sectors. Thus, initiatives may focus on issues such as policy reform or service delivery as a way of increasing capacity at the sector level (Macfadyen and Huntington, 2003).
- At the *organizational/institutional* level, organizational structures, processes, resources and management issues have been of great importance and the focus has been on assistance in the form of technical assistance, budgetary or infrastructure support, or support for institutional linkages (Macfadyen and Huntington, 2003). Existing capacities or initiatives should be sought out and allowed/encouraged to develop, considering the construction of new institutions only if this is not feasible (Fukuda-Parr *et al.* 2001).
- In order to create an *enabling environment*, initiatives at the societal level tend to focus on the principles of good governance. High levels of commitment and mechanisms to resolve conflict support an enabling environment, whereas low accountability and high levels of corruption contribute to disabling the policy environment (Macfadyen and Huntington, 2003).

Capacity building must involve a process of individual capacity development, during which new knowledge and the abilities of individuals eventually feed into and contribute to an institutional, sectoral or societal change, be it a systemic or a structural improvement. At the same time, a change in the collective behaviour may support new levels of performance and form new patterns of behaviour. This process is not linear and individuals need to continue building on existing core skills and capacities, so the process requires time. Another aspect linked to the time requirement is that capacity development as a process may produce uncertain or intangible results that are not easily measurable. Quick-fixes with predictable and easily measurable results are therefore not feasible. Lastly, the permanence and sustainability of capacity development, and the changes it entails, depend on ways to retain the acquired knowledge/abilities/capacities (e.g. keeping institutional knowledge in the face of high turnover) (Macfadyen and Huntington, 2003).

Capacity development is not a new concept and the following key lessons, adapted from Macfadyen and Huntington (2003), have thus been drawn from previous activities:

- Capacity development initiatives must be participatory in design, implementation and monitoring. Initiatives must build on core capacities and be a two-way process of knowledge transfer.

- Initiatives must provide for flexible and suitable learning pathways, i.e. capacity-building must be adapted to the local situation and local requirements. One size does not fit all.
- Approaches must take cognizance of the overall societal/political context in which initiatives operate.
- There is need for much better integration of initiatives based on regional, geographical, intra-sectoral, intersectoral, and vertical linkages.
- Appropriate incentives must be built into capacity development initiatives.
- Those delivering capacity development may themselves require capacity development for effective delivery.

Askvik (1993, referenced in Hersoug, 2004) presented some general problems in the process of capacity development that merit consideration when designing and implementing a capacity building programme:

- Rapid turnover of staff due to qualified people disappearing during the project period. Since the people taking part in the training often acquire valuable qualifications, they may be found attractive in other work areas and may be tempted by higher salaries offered in those other areas.
- Knowledge, *per se*, does not always give authority in an organization/institution. Sometimes newly trained staff cannot apply this new knowledge in the organization, e.g. because the leader has not given his consent. A way of getting around this, though, is to start by training the top leadership.
- A lack of coordination in the process may lead to increased differences in the same institution.

As an end note, it should be stressed that attaining adequate institutional capacity is vital, not only to achieve a well-functioning system of EAF management, but also in order to sustain it. It is, however, important to bear in mind that it is not feasible to expect the creation of a completely new system. Changes will more often be incremental and build on existing capacities, because institutional adjustments and related capacity development are costly and time-consuming, and may therefore be restrained by lack of financing.

Use and management rights

Recognizing and/or assigning rights in fisheries represents a mechanism to be clear about who has access to the fishery (i.e. to go fishing) and to what extent, as well as who has the right to be involved in fisheries management itself. While the existence of rights over the use and management of the fishery does not necessarily constitute an incentive as such, once in place, the hope is that they will create desired incentives.

Some key considerations with regard to rights arrangements (see Charles, 2002) are as follows:

- A system of use rights is an institutional mechanism by which fishers, fisher organizations and/or fishing communities hold rights and some security of tenure over access to a fishing area, the use of an allowable set of inputs, or the harvest of a quantity of fish. If use rights are well established, there is increased clarity with respect to who can access the fishery resources and how much fishing each is allowed to do. This implies that fishers will have greater security; they know that with use rights, they are securely in the fishery for a certain time period to come.
- Management rights – rights to be involved in managing the fishery – reflects the need, as noted in the Code of Conduct (Paragraph 6.13), to "facilitate consultation and the effective participation of industry, fishworkers, environmental and other interested organizations in decision-making with respect to the development of laws and policies related to fisheries management…". This has led notably to the emergence of co-management arrangements involving joint development of management measures by fishers, government and possibly local communities.

Through use rights and management rights, it is hoped that greater incentives will be in place to increase the possibility that participants will:

1. adopt a longer-term perspective on the fishery, since (with conditions of open access removed) their use rights are secure over a longer-term, so protecting "the future" becomes more compatible with their own long-term interests, in keeping with the Code of Conduct for Responsible Fisheries,
2. support and comply with management regulations, since those with management rights have been involved in developing the regulations in the management process, and
3. engage in greater cooperation, since one's well-being may become more closely intertwined with that of others.

Use rights can be divided into two sub-components (Charles, 2002): *access rights* – e.g. territorial use rights (TURFs) and limited licensing – and *withdrawal* rights (further separated into input and output rights). For a review of experiences with use rights and output (quota) rights in fisheries management, see FAO 2000a and 2001b, respectively. FAO (1982) provides a discussion on the conditions affecting the successful creation and maintenance of TURFs, which may be found across the globe and have usually developed in situations with historic roots of community-based management of natural resources.

While use rights and management rights have been well-discussed in the general fisheries literature, there are some specific considerations that need addressing with respect to EAF implementation. In particular, as EAF implies a broader scope of fisheries management (to include multiple species, the aquatic ecosystem, the range of societal objectives, and any interactions with other economic sectors, amongst other aspects), use and management rights within such a context will need to deal with other "users"of the ecosystem beside the specific stakeholders in the fishery being addressed. Other fisheries, aquaculture, offshore oil and mining activities, eco-tourism and/or coastal tourism, shipping, urban development, coastal industries, and other aquatic-based human endeavours all vie for resources and impact on the ecosystem along with fisheries. Just as rights may be allocated to use specific fishery resources and to be involved in managing those resources, so too may there be rights arrangements for others – perhaps in the context of integrated coastal and ocean management, or integrated watershed management. While this goes beyond EAF *per se*, clearly it is a reality that must be taken into account, and which bears very much on the broader goal of ecosystem health, which necessarily involves more than just those within the fishery.

In summary, the judicious recognition or adoption of use rights and management rights can help align incentives to desired EAF policy, but this is not a simple task, and indeed taking the wrong approach can produce results contrary to the aims of EAF management. In particular, a rights system will always have accompanying benefits and costs (and varying distributional impacts of each) so there is a need to assess these aspects (as well as monitoring any negative impacts of the measures). Thus it is important to understand the relationship between rights and incentives, which will vary from case to case.

Legal incentives

The long-term prospects of applying EAF will be enhanced by clear and facilitating legal arrangements, supporting the corresponding policy frameworks (see Chapter 3) and institutional frameworks (discussed in this chapter). A supporting legal framework can provide the legal basis for many of the required changes by, amongst other things:

- providing a framework for coordination and integration;
- defining roles and responsibilities;
- providing a framework for the management processes; and
- providing legal mechanisms for conflict resolution.

At an international level, the EAF is currently supported mainly through voluntary instruments – such as the Rio Declaration, Agenda 21, the Code of Conduct for Responsible Fisheries and the Reykjavik Declaration – rather than in binding international law. This results in little explicit recognition of EAF within the legal frameworks of regional fisheries organizations and arrangements (FAO, 2003a).

At a national level, the EAF is frequently not an integral part of national fisheries policy and legislation. This leads to weak capability for cross-sectoral consultation and cooperation, and the failure to consider, or a legal inability to act on, external influences such as pollution and habitat deterioration in current fishery management regimes. Furthermore, implementing EAF effectively not only requires suitable fisheries legislation but would also benefit from suitable legal frameworks in other sectors. Thus, existing legal instruments in fisheries, and in other sectors that interact with or impact on fisheries, need to be assessed and adjustments to those instruments made where needed and where possible (FAO, 2003a).

This section will briefly discuss the role of a supporting legal framework in implementing EAF.

How can a legal framework help in the implementation of EAF?

A legal framework can specify the policy-making entity, the geographical area the policy covers, the stakeholders bound by the policy, the institutions respectively responsible for implementing and for enforcing the management plan, and how interinstitution jurisdictional disputes will be resolved. This reduces overlap and conflicts both between sectoral management institutions and between different tiers of government, by delineating roles and responsibilities (FAO, 1997).

The legal framework should provide the legal backbone for implementing EAF and its relevant principles and policies by supplying the following support:

- **Coordination and integration, roles and responsibility**

As mentioned above, effective application of EAF will require coordination and integration of sectoral and institutional responsibilities and activities as a way of dealing with the increased management scope. The legal framework can facilitate this by defining interconnections and integration of management authorities (broadening from a traditional single-sector focus). By defining the institutional structure for fisheries management and empowering this structure with the corresponding authority, roles are set out at each level of governance, which is essential as it sets out who is entitled to administer and control the use of the fisheries resources (FAO, 1997).

- **Framework for management processes**

A legal framework can also provide a framework for management processes. For example, it can supply the basis for formulation, monitoring and implementation of fisheries management plans, including the necessary powers to formulate appropriate management measures and enforce the related fisheries regulations (FAO, 1997).

- **Legal status of rights system**

A legal framework provides the legal status of a rights system. For example, it may set out who is in charge of determining allocation of total allowable catch (TAC), and what the guidelines for such allocation are (Van Anrooy *et al*., 2006).

- **Pro-poor legislation**

A legal framework constitutes a way of supporting small-scale fisheries, of which many are poor, by legislating pro-poor policies, as mentioned in Chapter 3. For example, the legal framework can ensure that various rights of small-scale fishers and fishworkers are enshrined in law, thereby preventing an erosion of such rights through social, economic and political marginalization (FAO, 2005b).

- **International norms and agreements**

A legal framework describes the requirements (e.g. at a national level) for the application of international norms and agreements, including recommendations by regional fisheries bodies.

- **Conflict resolution**

Another important function of any fisheries legal regime is to establish the institutional arrangements and procedures necessary to reduce potential conflicts and facilitate their resolution when they occur. As conflicts between different stakeholders are likely to arise, having formal procedures and a transparent dispute settlement process may facilitate the implementation of EAF (FAO, 1997).

What is required of the legal framework?

- **Flexibility**

The legal framework needs to be flexible and responsive to various changes, for example changes in the knowledge base, and biological, ecological and socio-economic changes. However, simultaneously it needs to be stable enough to provide continuity. At a national level, the primary legislation lays down principles and policies and is generally broad in scope, and should specify the "functions, powers and responsibilities of government or other institutions involved in fisheries management" (Chapter 4.3.1 iv of FAO, 1997). It may also reflect varying degrees of detail of implementation, such as the main features of a specific mechanism (e.g. that controlling the allocation of fishing rights). Responsible fisheries management requires, however, that the primary fisheries legislation should, as far as possible, not be subject to frequent changes, hence the primary legislation may provide the necessary continuity (FAO, 1997). As many interactions between fisheries and other sectors will be dynamic, it may be preferable to rely on agreed rules instead. This is consistent with the advice in the EAF Guidelines, namely that routine management control measures needing frequent revision should be included in subordinate legislation, rather than in the primary legislation.

- **Harmonization**

As ecosystems are often covered by several overlapping legal regimes (maritime, forestry, water, agriculture, etc.), and also frequently overlapping national legislation, there is a need for harmonization between fisheries legislation and the other sectors' sets of legal instruments, both within and between nations (FAO, 1997). One example of such harmonization is a project set up in the Benguela Current Large Marine Ecosystem (BCLME) region. This ecosystem is shared by three countries – Angola, Namibia and South Africa. The aim of the project is to facilitate harmonization of these countries' national environmental policies and legislation for marine mining, dredging and offshore petroleum exploration and production activities in the region. The project has identified areas of similarity and differences in terms of policies and legislation, and their implementation, and drew up draft guidelines on areas where regional harmonization would be beneficial, e.g. standardized water quality criteria and environmental management reporting (BCLME Programme website).

Financial/material incentives

Financial incentive mechanisms that are created outside existing markets are based on the idea of establishing a situation in which economic actors/agents are convinced that it is in their private interest to make the socially correct choices.[39] The underlying rationale, from an economics perspective, for why such incentives are needed is described in Appendix 7.1. The key point is that in the absence of incentive-aligning corrections, market failures will continue to exist, leading to outcomes that are not socially optimal.

In the EAF Guidelines, the discussion on financial measures is divided into two categories: market-based incentives (e.g. ecolabelling and tradable rights) and non-market-based incentives (taxes, subsidies). The distinction is made to reflect the idea

[39] For example, these may be market-based incentives, which contrast with "command and control" approaches that may have excessive information and MCS demands on the governing and governed bodies. For further discussion of market-based approaches, the classic reference is Tietenberg (2004).

that, in the former, a buyer and seller interact in the market to determine the price of a good or service; whereas, in the latter, it is the governmental authority defining and imposing changes to the profit function of the fishery.

In this report, the discussion has been separated into "carrot" and "stick" incentives categories – we refer below to "economic incentives" as the "carrots" that promote desired behaviour, and "economic disincentives" as the "sticks" that penalize undesirable behaviour.

Positive monetary incentives (the carrot)

The use of positive incentives may be split into three categories: conservation price differentials, best-practice/conservation payments, and rights-based incentives. From an economic perspective, all of these seek to shift cost and revenue curves with the aim to attaining a socially optimal level of fishing effort. In addition, positive economic incentive instruments would, in theory, allow actors to determine for themselves the least cost means of obtaining a given management objective.

Price differential payments are one form of recognition by consumers of the values they hold for ecosystem goods and services, and serve as market signals to industry and governments. For example, these payments may take the form of higher prices paid for "ecolabelled" products, which establish a mechanism for identifying sustainably produced products and may relate to price premiums or export certificates. The most well-known environmental labelling standard[40] for sustainably managed fisheries is the Marine Stewardship Council ecolabel, which is an attempt to allow consumers to promote environmentally responsible stewardship of fisheries resources. The impact on the international market has begun to make itself felt as large retailers pick up on the movement and, perhaps, the price differentiation.

In his July, 2000 article, J. Kurien voiced several concerns regarding market-based incentives, such as eco-labels, and their role in sustainable development. Many of these concerns were mirrored and discussed in the FAO Technical Paper, "Product Certification and Ecolabelling for Fisheries Sustainability" FAO (2001a). Box 13 provides a brief summary of the opportunities and concerns voiced regarding ecolabelling schemes.

A similar labelling system exists in the marine aquarium fishery sector through the Marine Aquarium Council (MAC) certification label. From its Internet site[41] the MAC mission is "to conserve coral reefs and other marine ecosystems by creating standards and certification for those engaged in the collection and care of ornamental marine life from reef to aquarium".

Other attempts to affect consumer choices include fair-trade labels, good fish guides[42], and the fish fairs, such as the Slow Food/Fish movement. Such instruments are geared towards the providing of information to consumers regarding the circumstances leading to the availability of offered products (e.g. fishing practices, stock status, and management regimes). The fair-trade labels and Slow Food/Fish movement differ from the ecolabels and purchasing guides in that the focus is on the social and economic side of the fishery, as apposed to mainly biological arguments. For example, the Fairtrade Labelling Organization (FLO)[43] "exists to improve the position of the poor and disadvantaged producers in the developing world, by setting the Fairtrade standards and by creating a framework that enables trade to take place at conditions respecting

[40] Other labelling schemes for capture fisheries exist, such as the Frozen at Sea Fillets Association's Ocean Wild Mark and the Earth Island Institute "Dolphin Safe" label.

[41] http://www.aquariumcouncil.org/

[42] These guides present lists of fish products ranked by some measure of biological sustainability and are usually focused on specific markets to assist consumers in their consumption choices of fish products commonly found in local markets or supermarkets.

[43] http://www.fairtrade.net

BOX 13

Possible opportunities and concerns surrounding ecolabelling of fish products

Opportunities

Environmental

- Ecolabelling could provide the needed economic incentives for better long-term stewardship and availability of natural resources important for national economic welfare
- Ecolabelling may generate political support for improved environmental management and to raise environmental standards through consumer choice

Economic

- Ecolabelling provides one of the least-coercive market-based mechanisms to improve conservation outcomes
- The economic benefits from ecolabelling may not be limited to price premiums received through ecolabels.
- Additional financial and technical resources may be mobilized in the ecolabelling process
- Consumer consciousness of environmental concerns is likely to grow in both the North and the South

Concerns

- Lack of transparency and opportunities for participation in the development of products standards
- Trade imbalances and decreased competitiveness may occur through the misuse of ecolabelling schemes
- High costs of bringing fisheries management practices into compliance with ecolabelling schemes, following the certification process, and maintaining certifiable status; which may fall disproportionately on small suppliers
- Inadequate institutional frameworks may make individual, voluntary compliance difficult
- Lack of international standards/guidelines may increase the burden on governments to monitor multiple schemes
- Consumer price premiums might not translate into higher incomes for the fishers
- National management sovereignty may be affected

Source: FAO, 2001a

their interest". The FLO estimated premiums for fair-trade labelled coffee of over US$22 million in 2003. If applied to fisheries, such labels may support small-scale fisheries using traditional sustainable fishing practices.

Best-practice/conservation payments are transfers to individual fishers and/or the fishing industry/community as a whole, from governments or other institutions, to compensate for some or all costs of implementing sustainable fishing practices. Such practices may include the use of best-available technologies (e.g. turtle exclusion devices, VMS) or restrictions on fishing patterns (e.g. no-take zones or seasons). These transfers may be considered as payments from those who benefit from conservation or best-practices to those who bear the direct costs of their implementation.

Along these lines are competitions to engage and reward the fishing industry in the design of fishery-specific technology. Such crossroads between regulatory mechanisms (i.e. the requirement of technological change) and allowing industry participation through the design of the most appropriate and lost cost options have met with some

success as creativity from within the industry is rewarded and the process tends to increase acceptance of use (see, for example, NFCC, 1994).

Conservation payments can occur when the non-use/existence benefits of certain resources are higher than the extractive use benefits. In these cases, the opportunity costs of not using the resources need to be compensated, either through direct or indirect transfers. This is especially important in small-scale fisheries that depend on the extractive uses for their livelihoods. Direct payments have been used by specific conservation projects in which fishing communities are paid to maintain a given habitat or not to use a resource. Unfortunately, such payments are usually constrained by the longevity of the given project, in that once the project has finished, so do the conservation payments. Ferraro and Kiss (2002) present a review of current debates regarding direct payments to conserve biodiversity.

Other conservation payments have focused on indirect transfers focusing on training or other livelihood diversification methods, based on the thesis that reducing fishing communities' vulnerability will naturally increase their ability to sustainably use and management fisheries resources (SFLP 2006).

Eco-tourism is another market-based conservation mechanism targeting the substitution of extractive uses of resources to non-extractive uses. Essentially, payments from tourism compensate for lost fishing revenues and may provide for alternative or diversified livelihood sources. Box 14 provides the results of one review analyzing the potential of eco-tourism as a substitute for commercial whale shark fishing. However, as is often the case for substitutes, negative impacts on ecosystems may occur (e.g. pollution, crowding, and noise from boats and divers), thereby warranting caution in their use. In addition, the demand for eco-tourism may not be sufficient and stable enough to guarantee conservation of habitats and commercial species and this demand may only pertain to highly valued species, such as sharks, whales and turtles.

Monetary disincentives (the stick)

Economic disincentives within an EAF context mirror the "polluter pays" and "user pays" principles (PPP and UPP, respectively) used in the allocation of costs of pollution prevention and control measures and sustainable development paradigms.[44] These principles attempt to correct for existing market failures by internalizing into the production decision-making process the costs of using natural resources and of negative impacts on the ecosystem. Such principles have become standard policy in dealing with issues of water and air pollution, and hazardous chemicals/waste, while their application to the fisheries sector has been slower to materialize.

Coffey and Newcombe (2001) have provided an analysis of the current and potential use of PPP in European fisheries and the generalized results are presented here. The authors differentiate among a number of objectives for the use of economic instruments (e.g. taxes, charges, and levies[45]) in line with the PPP/UPP: in this discussion we look at (a) cost recovery for fisheries management, (b) paying for resource use, and (c) paying for environmental damage prevention or alleviation.

Cost recovery for fisheries management[46] is generally through taxes/levies; while not really a "stick" incentive measure, this will change the private profit functions

[44] The polluter pays principle means that the polluter bears the expenses related to any pollution prevention and control measures; meaning that these costs are reflected in the cost of goods and services which cause pollution in production and/or consumption. The user pays principle is a variation on the polluter pays principle that "calls upon the user of a natural resource to bear the cost of running down natural capital" (UNSD, undated).

[45] The word taxes will be used interchangeably in the text for taxes, charges, fees, and levies.

[46] In Australia, for example, cost recovery for fisheries management "means that the commercial fishing industry pays for those costs directly related to fishing activity, while the Commonwealth government pays for management activities that may benefit the broader community (as well as the industry) and that satisfy a range of specific community service obligations" (Cox, 2000).

BOX 14

"A live shark is worth more than a dead one"

R.T. Graham (2004) studied this argument with respect to whale sharks. The following extracted text presents her review of relative studies and conclusions:

"In Taiwan, whole whale sharks sold for US$7 116 for a 2 000 kg individual and US$21 400 for a 10 000 kg shark, with retail prices for meat ranging from US$4.9–17.2 kg. By comparison, in Ningaloo Reef, Western Australia, whale shark tourism revenues are estimated at Aus$4.7 million (US$3.1 million) for a two-month season and a more recent estimate (for 2002) is Aus$12 million (US$7.8 million). From visitor surveys conducted in Belize in 2002, the value of a six week whale shark tourism season was estimated at US$3.7 million nationally and US$1.35 million to the five stakeholder communities of the Gladden Spit Marine Reserve. This site on the Belize Barrier Reef hosts a seasonal congregation of whale sharks that feed on the eggs of snappers. There are at least 12 additional sites worldwide for predictable sightings of whale sharks, (Mexico-Baja, South Africa, Mozambique, Honduras, the Seychelles, Galapagos (Ecuador), Thailand, Maldives, India, Japan, Malaysia and Philippines). With land-based tours from US$40–266 per day and luxury live-aboard tourism worth considerably more, global whale shark tourism could be worth conservatively at least US$47.5 million annually. With the exception of Australia, the majority of this revenue is captured by developing countries and presents a considerable incentive to conserve whale sharks.

Ascertaining a value for an individual shark is complex, particularly if the population is unknown and the shark migrates between several tourism sites. In Belize, a minimum of 106 individuals have been photo-identified, and many travel throughout the Belize Barrier Reef returning yearly to feed. Using the 2002 Belize whale shark tourism survey results, each shark is worth at least US$34 906 annually. A similar annual value of US$33 500 for each grey reef shark *Carcharhinus amblyrhynchos* was recorded in the Maldives. If whale sharks live to at least 60 years old, then an individual might be worth US$2 094 340 over its lifetime providing it repeatedly visits the tourism site. Several whale sharks tagged in Belize have moved between Gladden Spit and tourism sites in Honduras and the Yucatan, Mexico, therefore producing greater revenue. If each site generates as much as Gladden Spit, then a whale shark's value could effectively be tripled to give US$104 718/individual/yr for the Mesoamerican Barrier Reef. Immigration of new individuals to Gladden Spit yearly suggests that the regional population is larger, thereby decreasing the individual value of each shark. Nevertheless, the economic argument for protecting whale sharks is undeniable."

Note: references included in the original text have been removed.

Source: Graham, 2004

of fishing activities and may instil a sense of ownership of the results of management as a direct link is made between the benefits of management and their costs (Cox, 2000).[47] The use of cost recovery mechanisms has, for the most part, been applied only within the OECD countries but explicit research on applying cost-recovery mechanisms elsewhere and implicit use within fisheries co-management regimes is

[47] The OECD has proposed further that including industry in the decisions about and in the provision and payment of management services is highly likely to create incentives to improve the fishery's performance and to increase the cost-effectiveness of management services (OECD, 2003).

occurring.[48] However, in cases where revenues are collected from fisheries activities, more often than not these revenues go directly to the central government budget and, therefore, the link between benefits and costs of management services cannot be made and fisheries authorities continue to base their management activities on governmental appropriations.

Paying for resource use – often through license/access fees, taxes, and tradable or auctioned quotas – is an acknowledgement within the fisheries sector of the value of natural resources, much as in the use of land, water, or other natural resources. Historically, access to fisheries resources was free and all profits from the use of these resources were either dissipated, in the case of open access fisheries, or kept by the fishing industry. Governments and, hence, societies, had not insisted on payments for the use of these natural resources. However, with the onset of the Law of the Sea in 1982[49] and the idea of national ownership/stewardship of marine resources, the idea of private individuals paying society for the use of natural resources has gained ethical acceptance and jurisdictional backing.

The level of such payments would depend on the particular fishery and the economic concept of resource rent, which is the return to the resource owner[50] from the use of a natural resource. In an open access fishery, rents are largely dissipated, i.e., there would be little or no rent to be had, and thus no rent extraction is possible. Moving from an open access fisheries to a socially regulated fishery would increase the available rents, all or some of which can be collected by society through appropriate rent collection in the fishery.

As an example of rent in fisheries, a review of capture fisheries management systems in the Indian Ocean countries (FAO, 2006a) revealed that resource rent recovery schemes, other than license fees, were uncommon within the large-scale and small-scale capture fisheries of the region. However, such schemes have been used within the recreational fisheries sub-sector. This difference between the sub-sectors may reflect whether access to the resources is assumed as a right (without payment) or as a privilege.

Third country access agreements (i.e. foreign fleets paying for the right to fish in another country's EEZ) have been used in cases where national fishing fleets do not have the capability of exploiting certain stocks and the coastal nation could benefit from rent extraction through collection of lump-sum fees and taxes. These agreements have been wrought with criticisms (e.g. IEEP, 2003) but with the growth of information sharing[51] experience and monitoring capabilities[52] such agreements may be able to benefit national economies while ensuring sustainable harvest levels.

Paying for environmental damage prevention or alleviation – either through bearing the costs of appropriate technology or through paying fines for damages inflicted – can be a politically palatable use of economic incentives, as it relates to a given "bad" action. The fining of actions that have negatively affected ecosystems is quite common; however, these cases tend to involve actors outside of the fishing sector who have damaged habitat, such as oil spills or dock building.[53]

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[48] See, for example, the analysis by Keizire (2001) of fisheries management financing in Uganda, and the Asia-Pacific Fishery Commission (APFIC, 2005) work regarding the implementation of fisheries co-management.

[49] United Nations Convention on the Law of the Sea of 10 December 1982. See http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm

[50] "In relation to fisheries, a "rent" is generally thought of as the difference between total revenues obtained from the fishery and the total costs (estimated at their opportunity costs) of employing the various factors of production that together make up the enterprises participating in the fishery." FAO (2000b)

[51] To this aim, WWF has created a "Handbook for negotiating fishing access agreements" (Martin *et al.*, 2001).

[52] See FAO (2002) for guidelines on monitoring, control, and surveillance (MCS) aspects within access agreements.

[53] See Chapter 8 External Financing for the EAF.

BOX 15

CITES' reward for sustainable Queen Conch fisheries management in Jamaica

Until 1999, Jamaica was the world's largest producer of queen conch. Most of this was fished on the Pedro Banks, a large undersea area that is the habitat for one of the Caribbean's largest and most important queen conch stocks. In the early 1990s, Jamaica's landings of Pedro Banks conch topped 3 000 tonnes per year. Jamaica also conducted its first conch stock assessments in the early 1990s. Recognizing a decline in the resource, the Jamaican government introduced annual catch and export quotas, implemented in 1994 in Jamaica's first conch fishery management plan. MSY for queen conch was calculated at 700-1 300 mt/year. Unfortunately, illegal fishing is now rampant on the Pedro Banks, much of it by foreign vessels that simply ignore Jamaican law. In the years 1999-2002, illegal harvest was estimated to account for 40 percent of the conch fishing on the Pedro Banks. Jamaica conducted its third conch stock assessment in 2003. Although this stock assessment suggested a total allowable catch of 900 tonnes, Jamaica set its conch export quota at 500 mt to allow for some inevitable losses to illegal fishing. The Caribbean Fishery Management Council's regional workshop on queen conch stock assessment and management noted that Jamaica employs a visual-census conch survey as a fishery-independent monitor of conch populations. Based upon the findings of its September 2003 Significant Trade Review, CITES considers Jamaica to have an adequate conch management regime and relatively healthy queen conch populations. Jamaica is one of only two Caribbean conch-exporting nations to earn the CITES designation of "least concern" for its queen conch resources.

Source: extracted from Cascorbi, 2004.

Fining of fishing activities that have harmed the ecosystem (e.g. dynamite fishing, destructive anchoring, discarded bycatch, and incidental fishing of marine mammals) could be implemented. However, is more common at present for effort to focus on attempting to limit such actions through regulations such as no-take zones, gear restrictions and bycatch limits. This may be because a regulatory approach is administratively easier to implement (Coffey and Newcombe, 2001) or perhaps the calculation of fines is excessively complicated, e.g. if the necessary knowledge regarding the value of lost ecosystem goods and services[54] is not available.

One economic disincentive in use with respect to harmful fishing activities is the use of trade barriers. An economic incentive in support of sustainable fishing practices is the granting of export permits for the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)[55] listed species. CITES was developed to minimize the effect of international trade on commercial species threatened with extinction (Appendix I species) or exploited unsustainably (Appendix II species). Trade in Appendix I species is all but prohibited; while trade is permitted for Appendix II-listed species if the related fishing practices are proved sustainable (i.e. the species "was legally obtained and if the export will not be detrimental to the survival of the species"). If the potential exporter is unable to prove the sustainability of the fishery, exportation rights are not granted. In theory, sustainable management of fisheries should keep the commercial species from being placed on the CITES listing. Box 15 presents one example in which a sustainable management regime has enabled the Jamaican Queen Conch fishery to be labeled as a fishery of "least concern" for its queen conch resources.

[54] See Chapter 2 Human Values of Ecosystem Services.

[55] See http://www.cites.org/

The current lack of information regarding the social and economic impacts of CITES listing inhibits making conclusions regarding its role as an incentive for implementing EAF management with regards to traded species. FAO (2004b) provides a brief description of three categories of increased costs related to CITES listing: administrative costs (start-up training and capacity building and recurring research, processing, and monitoring and control costs); management impacts (developing effective management within and without the fisheries sector) and social and economic implications (short-term impacts on employment, income, and food security versus long-term positive impacts on stock productivity, the possible creation of legal markets, and the shifting of fishing effort to substitute fisheries).

Other trade barriers, such as the United States dolphin-safe tuna policy, create incentives to implement sustainable fishing practices. However, the effectiveness of such policies on sustainable practices may prove ineffective if other markets are available.

Although the PPP concept may now be found in more and more nations' fisheries legislation, and is applied in relation to the impacts of non-fisheries activities on fisheries habitats[56], it is difficult to claim a wide-spread use of such economic instruments. Coffey and Newcombe (2001) presented a few considerations as to why the use of economic disincentives with respect to environmental damage/control may prove difficult and these have been summarized and complemented in Box 16. Implicit in the shift towards PPP is the removal of perverse incentives (minimizing "harmful" subsidies) as, without doing so, effort will continue to rise; making ineffective and inefficient attempts to internalize the environmental costs of fishing activities.

Markets and prices

The role of market prices in sustainable development has tended to be understated. The absence of a market can cause problems, as noted in Chapter 2 concerning the challenge of placing proper values on ecosystem services when markets for these services do not exist. However, even when they are present, markets may provide incorrect signals regarding ecosystem services. Price ceilings or price floors set by governments, subsidies, and market failures send signals to users of ecosystem services that differ from what the true or societal value/price would dictate. Under-pricing of ecosystem services leads to overuse and probably waste of these services. Equally important, over-pricing may impact people's ability to use the services for basic needs, such as for food and livelihoods, even while these higher prices would benefit those selling goods produced from the ecosystem services.

It is important to note that prices, such as fishery input prices (e.g. petrol, kerosene, labour), directly impact on fishers' production activities. Prices also impact our ability to manage resources. If, for example, prices are very high for a certain species of fish, management measures aiming to reduce effort in this fishery will prove difficult, as the incentive to cheat is correspondingly high.

As shown in the next section, prices and their related profits are not the only motivating factor driving individual decisions, but they are certainly important enough to seek an understanding of them, and include them when designing any EAF management plan. Not only will management and policy measures relating to ecosystem services impact markets and trade, but markets and trade will impact on our ability to manage.

Social incentives

Whereas economic incentives imply material rewards or punishment, social incentives typically imply more intangible social rewards or punishment (i.e. approval or disapproval from others, and the related feelings of pride or shame) (Lindbeck, 1997).

[56] See Chapter 8 External Financing for the EAF.

BOX 16
Challenges in applying the PPP to the EAF management

Linking cause and effect

- impacts of fishing practices on ecosystems may be slow to appear and difficult to pinpoint due to ineffective monitoring, uncertainty regarding causes and effects, and a general lack of information
- unlike most point-source damage, the source of damage in fisheries cannot easily be traced back to an individual, although it may be possible to identify groups of vessels or fleets that have been fishing in a defined area

Institutional considerations

- command and control regulations may be easier to administer than taxes (e.g. gear and temporal restrictions)
- politically acceptable tax levels may be too low to serve as disincentives (i.e. better to risk the fine if caught)
- setting taxes at appropriate levels may be difficult in the face of damages to non-market values and services (i.e. where does the social cost curve lie?)
- perverse subsidies may be in place; hence, contradicting or rendering ineffective the PPP
- economic instruments are not the panacea and should form one part of a complete management regime

Social considerations

- small scale operators may face special difficulties in adapting to changing environmental requirements and may have a limited ability to pass on the costs of compliance or taxation to consumers
- certain taxes, such as flat taxes, may be regressive and affect the small-scale fisheries disproportionately
- if stakeholders are not included in the process leading to a tax, great resistance will be met in cases where access to the resources was previously effectively free, i.e. fishing seen as a right and not a privilege and, therefore, rent free
- there may be large up-front effects on the fishing industry (i.e. changes in effort levels)
- different taxes (i.e. whether direct or indirect, or whether targeting access, output or input) will affect individual choices differently; therefore, the tax system applied must depend on the characteristics of the fishery

Unintended consequences

- taxing one activity may incite individuals to misreport that activity or shift to other activities that are not taxed and which may have stronger negative impacts on the ecosystem
- there is a risk of double taxation if a new tax is established in a management regime already using licence fees or other forms of fishing rights; hence already capitalizing on the fishery's rent capacity

Source: amended from Coffey and Newcombe (2001)

Social incentives relate to the ways group behaviour and group interactions occur and form the context in which an individual makes decisions. Such incentives include moral structures, religious beliefs, peer pressure, gender relations, policy, social preferences, norms, rules, ethics, traditional value systems, social recognition, trust among the various stakeholders, and common interests. Each one of these incentives may have strong impacts on how an individual or a group makes decisions.

Religious beliefs, for example, may form the basis of how a community relates to the environment, ranging from the idea of the world being created for human benefit,

to that of humans being a part of nature, that is to be respected. In other words, one's beliefs can lead to strong environmental consciousness or to a sense that ecosystems can be exploited without limits based on ensuring sustainability of the resources.

Much of the previous discussion relating to institutional incentives overlaps with social incentives in that the institutional incentives affect groups of individuals, such as public awareness, transparency, education, capacity building, participatory processes, and sense of ownership/stewardship. These are all example of positive social incentives.

Moral structure, ethics, social relations, and peer pressure are also powerful incentives to engage or not to engage in an activity. Human beings are gregarious by nature, so the need to conform to what the society or community expects of them can be very strong. Risk of social ostracism can be a very strong deterrent against breaking established rules. Understanding the social organizations and, hence, social incentives in place will help decision-makers understand how individuals and communities make choices regarding their use of ecosystem services.

Social incentives may prove as potent as their monetary cousins in influencing individual and social behaviour and may lead to collective action impacting decision-makers in a common move towards sustainable development (Grafton *et al.*, 2005).

Perverse incentives

Perverse incentives are, from an EAF point of view, any policy or management measures that incite people or groups to act in a way that negatively impacts on an ecosystem's ability to provide services or, in other words, that lead to inefficient use of ecosystem resources. Examples of perverse incentives include:

- subsidies leading to over-investment in fishing capacity in a fishery in which management is unable to control fishing effort;
- buy-back programmes in which receipts from the sale of older boat are reinvested in modernized boats, thereby increasing fishing capacity
- contradictory regulations leading people to ignore the laws all together;
- laws against selling of bycatch that lead to increased discards; and
- governmental inducements for use of fishing methods with relatively great negative impacts on the ecosystem (e.g. modernization subsidies leading to greater use of bottom-contact gears).

Logical reasoning would suggest the abolishment of existing perverse incentives as a first step to EAF management. This could also provide substantial budgetary savings and greater credibility in the governance system.

CONCLUSIONS

The four categories of incentives discussed above (legal, institutional, economic, and social) require different sets of procedures and knowledge bases, and affect individuals and groups differently. Therefore, some incentives may be more effective than others depending on the situation at hand. In addition, no one single incentive measure will make an unsustainable fishery sustainable. Thoughtful and creative mixes of these incentives will increase the probability of obtaining desired results. The elimination of perverse incentives, and efforts to obtain a better understanding of the motivations of fishers and other users of ecosystem services, will help determine which incentives to consider.

APPENDIX 7.1
An economic analysis of the need for appropriate incentives

From an economics perspective, the need for appropriate incentives arises from the need to address a range of market failures caused by the realities of public goods, externalities, monopolies, etc. – ones which are such that the costs and/or benefits to society of individual actions are not internalized (i.e. not reflected in the price), leading to results that are not socially optimal.

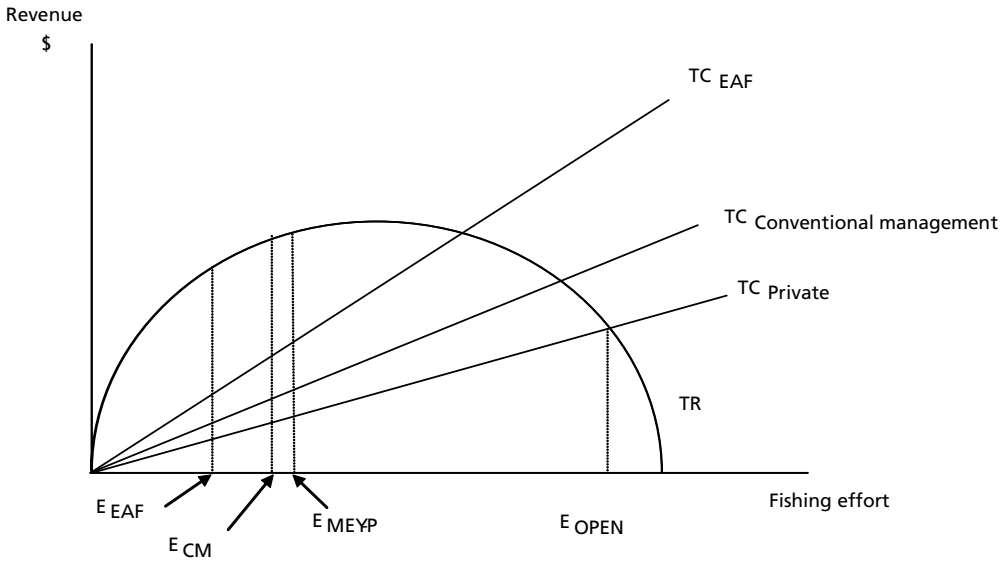
The most obvious fisheries example of such market failures is the "failure of the commons", in which the race to fish (i.e. if fisherman X does not fish the fish, fisherman Y surely will) is fed by an inability of the resource users to maximize the value (rent) of the aquatic resources. Waiting for a fish to reach a mature post-spawning stage, or a higher price class, means risking not catching that fish at all. This situation is classically portrayed as in Figure 7 by the open-access level of effort, $E_{OPEN,}$ at which all economic rent is dissipated and fishing effort is both economically and biologically excessive.

In this same figure, E_{MEY-P} represents the profit maximizing effort level that would occur if, for example, the actors in the fishery were able to control fishing effort to the "maximum economic yield" level, representing a move towards economic efficiency. However, at this level of fishing effort, it is possible that some impacts to society were not incorporated into the private decision making process; therefore, representing a socially sub-optimal level of fishing effort. The results of such market failures in fisheries may include discarded bycatch, incidental fishing of marine mammals and birds, and impacts on habitats in which the social costs of fishing are higher than the private costs imposed by the market.

This may be represented in Figure 7 by the difference in fishing effort $E_{MEY-P} - E_{EAF} > 0$, where E_{EAF} represents the theoretically socially optimal level of fishing effort in which all social costs have been incorporated into the fishery.

An intermediary effort level – representing what could be the output of current fisheries management in which some sustainability concepts have been incorporated

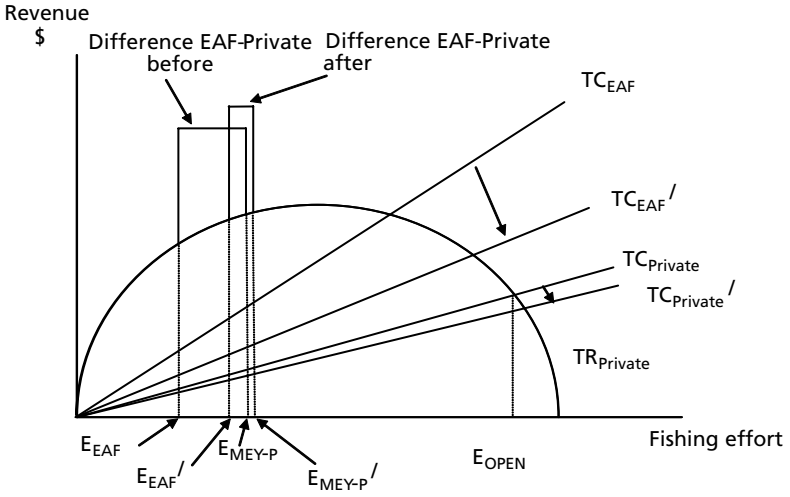
FIGURE 7
The EAF and the Gordon-Schaeffer Model



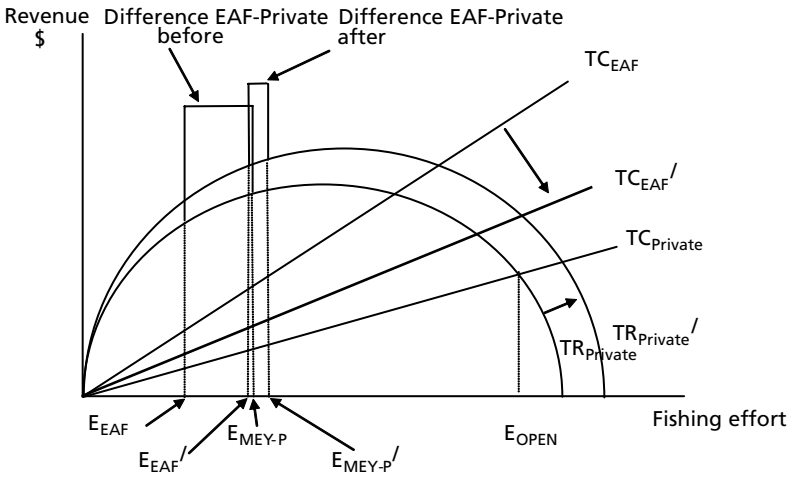
Notes: "Private" indicates the perspective of the fishing industry in which externalities of fishing activities have not been taken into account; "Conventional Management" indicates a fishing industry in which some externalities have been incorporated through the management system; and "EAF" indicates a fishing industry in which all externalities have been incorporated (i.e., is socially optimal).
- For a discussion of applied fisheries models and their assumptions, see Hannesson (2003).

FIGURE 8
Hypothetical examples of management measures and their effects on the socially optimal level of fishing effort

Example 1 Implementation of bycatch reduction devices



Example 2 Creation of a marine reserve



Note: the symbol '/'represents the value of the variable after the given change (i.e. TR shifts to TR/ after the creation of the marine reserve.

into fisheries management and have manifested themselves through, for example, taxes, fees or quotas – would be E_{CM}. The existence and placement of the underlying Total Cost curve ($TC_{Conventional\ Management}$) would depend on the current management regime in a given fishery.

Moving from E_{OPEN} to $E_{MEY\text{-}P}$ (or E_{CM}) could be associated with the implementation of traditional fisheries management practices, independently of an ecosystem-based management regime. Moving from $E_{MEY\text{-}P}$ to E_{EAF} could represent the incremental changes that would reflect an ecosystem-based management regime.

In order to demonstrate the effects of EAF-based management measures on fisheries production functions and, hence, effort levels, two fictitious and simplified examples are provided in Figure 8: one in which bycatch reduction devices are introduced into a fisheries and one in which a marine reserve system is put into place. The former affects

the cost function of the fishery; while the latter affects its revenue function. Both relate to technical measures within the management "tool box" available to fisheries managers (the reader is referred to Chapter 3 of the EAF Guidelines for further discussion.

In the first hypothetical example, it is assumed that bycatch reduction devices lower the Total Cost to society (TC_{EAF}) of the fishing activity by, for example, decreasing bycatch or fishing mortality of non-targeted species. The Total Private Cost ($TC_{Private}$) is assumed to decrease with the use of bycatch reduction devices due to, for example, increases in fishing efficiency and decreased time dedicated to culling unwanted bycatch (other things being equal).

Total net social welfare increases when the difference ($E_{MEY\text{-}P} - E_{EAF}$) > ($E_{MEY\text{-}P}{}' - E_{EAF}{}'$). Of course, the ultimate effect on effort in the fishery would depend on the biological and production functions of the specific fishery and, in the case where effort decreases, the resulting social and economic impacts would need to be addressed.[38]

In the second hypothetical example, a marine reserve is created to improve the productivity of the given ecosystem by protecting specific fishery grounds and allowing spill-over of the increased production. In such a case, the revenue function for the fishery, therefore, shifts outward; benefiting the fishery. The example assumes that the cost structure of the fishermen has not changed but that the Total Cost to Society decreases due to increased habit and species protection.

In both cases, the final effort level in the fishery, $E_{MEY\text{-}P}$, may not be identical to the socially efficient level, E_{EAF}; however, the difference between the two has decreased. As with any management regime, a suite of management tools would be necessary to close this gap.

[38] Valdimarsson and Metzner (2005) present a matrix describing ways in which EAF management may affect social welfare and commercial profits.

APPENDIX 7.2
Kenya and Lake Victoria

Despite attempts to control fishing pressure through setting and implementing fisheries regulations, the Kenyan government continued to observe declining fish stocks in Lake Victoria. A new approach was introduced by the Fisheries Department (the Department) – stakeholder participation in the fisheries management as a way to assure sustainable resource use was applied to various fisheries ecosystems. In 2000, the Department began consultations with communities at a grass-roots level in order to increase awareness of both the fish stock trends, and of the role communities could play in reversing this trend.

A stakeholder meeting for the Kenyan section of Lake Victoria was organized by the Department in 2001, which was attended by all stakeholders and key players in the industry, including Lake Victoria Fisheries Organization (LVFO) Secretariat and the research coordinators for the Lake Victoria (regional) research and environmental management projects. The main outcomes of this meeting were various fisheries management measures which could possibly reverse the decline.

One suggested measure consisted of closed seasons and areas. At the end of the first closed season, there was an abundance of good quality target fish and a recovery of non-target fish such as tilapia. During the closed period, the fishers participated in the surveillance and law enforcement, for example by reporting those who violated the new regulation with respect to closed seasons. The second closed season, in 2003, was therefore less resisted and through general consensus, it was also decided to ban any trade in the target fish (*omena*) during the closed season to discourage illegal fishing activity due to available market.

Another outcome of the meeting was an expressed willingness of fishers to actively participate in the management of the Lake Victoria fisheries. This resulted in the formation of Beach Management Units (BMUs), which are being developed to assist communities in taking the lead in fisheries management. The results of this approach were:

- A decline in destructive fishing gears.
- An increase in resource friendly gears.
- The apparent decline in Nile perch landings which could be attributed to the integrated concerted law enforcement effort that reduced the harvesting of large volumes of immature fish, whose market has been significantly reduced.
- Facilitation of development of strategies for conflict resolution and sustainable fish stocks utilization in several Kenyan fisheries waters, which could be attributed to the ongoing fisheries stakeholders' meetings.
- Higher compliance, achieved due to involvement of stakeholders in the policy-making process from the outset. Resource users ended up policing themselves, encouraged by the sense of ownership stemming from the participatory approach. This lightens the government's burden in regard to law enforcement.

It should be noted that there are still prevailing surveillance weaknesses to be addressed, resulting from lack of surveillance facilities such as patrol boats and engines for both the Department of Fisheries and the fishing community.

Source: (Gitonga, undated)

APPENDIX 7.3
The Bunaken National Marine Park co-management initiative

In 1991, Bunaken National Park (BNP), Indonesia, was formally established as a marine national park and has since become one of Indonesia's most well-known marine ecotourism destinations. Within the park there are 22 villages with more than 30 000 inhabitants of whom most make a living from a combination of fishing and farming. Due to a history of insufficient stakeholder involvement, the park has suffered frequent conflicts and ineffective park management. Before 1998, the management was in the hands of the Ministry of Forestry's Bunaken National Park Office (BTNB). Local park users, especially fishers and the dive tourism industry, were not effectively involved in the management process. In addition, there was minimal funding for conservation and management industry, the enforcement system was ineffective, and the park zoning system was either misunderstood or ignored by the local people.

Conversely, the goal of the Bunaken National Park initiative was to develop an effective and sustainably financed model of multistakeholder co-management of a national marine park, in collaboration with the USAID's Natural Resources Management Program (NRM). Below follows a description of the components of the co-management initiative, and thereafter a list of lessons learned from the project.

Components of the Co-Management Initiative

- **Participatory zonation revision of BNP.** NRM assisted the BNP Office (BTNB) to work with the two primary park user groups (local villagers and the marine tourism sector) to revise the park's zonation system, realizing that a well-designed, easy to understand and thoroughly socialized zonation system is the foundation for effective management of the park.
- **Improved villager involvement in BNP management decisions through institutional development of the BNP Concerned Citizen's Forum (FMPTNB).** The FMPTNB is now active in all 22 villages in BNP and serves to represent the aspirations of approximately 30 000 villagers in management decisions, as well as serving to socialize management policy to its constituents.
- **Fostering private sector involvement in BNP management.** NRM provided technical assistance to the North Sulawesi Watersports Association (NSWA) and actively fostered the involvement of other private sector groups in BNP management.
- **Facilitation of multistakeholder co-management of BNP via institutional development of the BNP Management Advisory Board (DPTNB).** NRM provided development support to the executive secretariat of the DPTNB, which consisted of representatives from national, provincial and local government agencies, village stakeholders, the private tourism sector, academia, and environmental NGO's. The DPTNB represented a drastic departure from the traditional Indonesian model of top-down management of MPAs, and strived to make decentralized, participatory, transparent and accountable MPA management a reality.
- **Development of a portfolio of sustainable conservation financing mechanisms for BNP.** A ground-breaking decentralized park entrance fee system placed the DPTNB on the road to financial self-reliance. Other components in the developing financing portfolio include an international volunteers system to lower management costs, diversified government agency support, in-kind support from the local dive tourism sector, national and international grant support, visitor center merchandising and a possible endowment fund.
- **Development of an effective 24-hour patrol system for BNP.** An experimental joint patrol system involving park rangers, water police officers and local villagers proved highly effective in decreasing destructive fishing practices in the park.

- **Institutionalization of a scientific monitoring program to monitor effects of management activities on park resources.** In conjunction with WWF Wallacea, NRM is supporting park stakeholders in monitoring coral condition and reef fish stocks.

Lessons learned

- It is necessary to balance ecological values with socio-economic values to generate essential stakeholder political support for conservation of protected areas in regions with population pressures and/or priorities on economic growth and development.
- Building informed participation is a long-term process, requiring extensive capacity building and facilitation. Villagers, government and non-government stakeholders with long-term involvement in conservation management provide more innovative solutions and productive support for conservation management.
- Park managers and the rangers tasked with field management of the park commonly lack the community facilitation skills critical to ensuring broad stakeholder support and understanding of park management objectives. Training in facilitation skills for these park management personnel is an essential capacity-building measure before co-management can be effectively implemented.
- Co-management starts with the development of constituency-based partnerships, and then evolves to true co-management when the constituency-based partnerships then start working with each other. The evolution to co-management results in collaboration among often competing constituencies. Strong constituency partnerships provide a solid foundation for co-management.
- Community conservation campaigns through schools, mosques and churches can build effective local support for and pride in conservation initiatives. People will support conservation of their environment if they take pride in it. Of course, pride alone will not achieve conservation. Also important are economic incentives and enforcement of rules and regulations.
- Decentralization of conservation management works when roles and responsibilities are clear, and when there is a shared vision of goals and objectives. Decentralization does not work when there is competition over management authority or significant divergence in goals and objectives. Decentralization also stimulates stronger grass-roots democracy and principles of good governance.
- Co-management requires active involvement of all relevant stakeholders. This is site specific in nature. In Bunaken it includes dive operators, communities, different levels of government, universities and NGOs.
- The composition of multistakeholder co-management boards is absolutely critical to their success. The optimal ratio of governmental to non-governmental representatives and those advocating different functions of the protected area (economic development, conservation, sustainable resource use) will vary from site to site, but will have profound consequences for the effectiveness of these boards. There must be a balance among the competing interests – this will not always imply equal numerical representation; in many cases the stakeholder group(s) that are the most hesitant to advocate strong positions may require a larger allocation of seats on a multistakeholder board to achieve truly equal representation.
- Community stakeholders support patrol and enforcement programs, as they are directly linked to increased livelihoods. Many illegal activities within protected areas come from outsiders. Communities with a stake in conservation management or sustainable utilization of park resources have a strong and rational interest in seeing rules and regulations enforced so natural resources are sustained.
- "Alternative livelihood programs" aimed at stakeholders currently involved in destructive activities in the coastal zone are ineffective and largely rejected by local

communities. Community conservation/improvement programs should focus on rewarding those that have chosen sustainable livelihoods, while those that persevere with destructive activities should be dealt with by a strong enforcement system.

- Local self-financing mechanisms are key to providing local stakeholders with the fuel to manage local conservation interventions. Decentralized co-management requires the capacity to generate and then manage finances locally.
- Development-oriented stakeholders, particularly from government, support conservation when it can be linked to regional economic development.

Source: Adapted from Erdmann *et al*., undated.

8. External financing for the EAF

INTRODUCTION

In Chapter 6, a range of potential costs and benefits related to EAF management were described. Chapter 7 described mechanisms to internalize – through suitable incentive mechanisms – some of these costs and benefits into the fishing actor's decision making process, thereby addressing some of the costs related to the EAF (e.g. cost-recovery and rent recovery). As great a use as possible of these mechanisms, to *internalize* the costs of EAF implementation, minimizes the need for external funding. Such self-sustainability is a desired route to EAF implementation.

However, if internal mechanisms cannot cover all implementation costs – a possibility given the potential for additional EAF-related costs (administrative, cultural, educational, and physical) and varied scales of benefits (local, regional, and global) – those costs will need to be covered either (1) through general government coffers and through the relevant authorities' budgets, or (2) through external financing arrangements. The appropriate route to financing will depend not only on the financial situation at hand (e.g. whether or not a government is *able* to cover EAF implementation costs) but also on the question of who *should* be paying those costs – and in particular the extent to which the beneficiaries of adopting an ecosystem approach to fisheries are in fact those who pay the costs of implementing it.

This chapter considers these matters, identifying potential sources of funding to complement government and fisheries' sources. These sources are organized into two categories: (1) the polluter pays principle; (2) conservation mechanisms.

Many of the financing sources described here are derived from their use in other sectors, such as forestry and agriculture; however, experience in their application to aquatic ecosystems is being gained as recognition of their value (as described in Chapter 2) is increasing. Examples of their application to fisheries ecosystems are presented within the text.

"POLLUTER PAYS" FINANCING

Financing EAF implementation through a "polluter pays" approach involves collecting revenues from those using the natural resource and/or causing ecosystem damage, and using those funds to finance positive moves to EAF management. In addition to the polluter-pays and user-pays incentive mechanisms described in Chapter 7, governments and fisheries associations have begun reclaiming the restoration costs in dealing with ecosystem damage inflicted by actors outside of the fishery sector (e.g. upstream activities, changes to habitats, pollution, and destructive practices). Individuals convicted of damaging are required to either pay fines, which may or may not be directly related to damage costs, or more directly to repair the damage or pay for work related to the conservation and protection of the affected habitat. Box 17 provides a few examples of penalties imposed on non-fisheries sectors from ecosystem-damaging activities and how the resulting funds have been kept within the fisheries sector to improve fish stocks and fish habitat.

EXTERNAL CONSERVATION FINANCING

Two realities come together to influence the potential to finance EAF through another channel, that of "conservation financing". First, related to "polluter pays" is the idea

BOX 17

Examples of non-fisheries polluters paying for fishery ecosystem damages

Canada – Under the Federal Fisheries Act, the Department of Fisheries and Oceans (DFO) Canada uses fines from habitat violations to restore damaged fish habitat. The convicted offender pays money directly to repair fish habitat or enhance fish stocks, often through local non-profit environmental groups. For examples of such convictions, see DFO (2004).

United Kingdom – the Anglers' Conservation Association (ACA) represents its members in court cases against private and public entities polluting British lakes and rivers. Money collected is kept within member fishing clubs and used in rehabilitation trust funds. See http://www.a-c-a.org/whatwedo.html for examples.

United States of America – The Columbia River Estuarine Coastal Fund was established in 2004 through the collaboration of the Foundation, the Service and the US Attorneys for Oregon and the Western District of Washington from fines imposed on shipping companies that illegally discharged oily waste into the Pacific Ocean near the mouth of the Columbia River. Conservation and restoration projects will be funded with $1.2 million in community service payments from polluters. See http://www.nfwf.org

of "beneficiary pays", in this case implying that those receiving the benefits of EAF implementation should pay the costs required to achieve those goals.

Second, given a global increase in environmental awareness (i.e. the recognition of the goods and services provided by ecosystems and the need to minimize damaging impacts on these ecosystems), a desire to improve human conditions (i.e. decreasing hunger and poverty: improving livelihoods), and the hopes of holistic, decentralized natural resource management (i.e. through good governance, participatory processes, community-based management, and integrated resource management), the possibilities for garnering international funding sources for EAF activities are numerous (e.g. donor countries, international trust funds, development banks, funding facilities).

Combined, these two possibilities may lead to initiatives for the global community to financially support EAF efforts, particularly in jurisdictions that otherwise might be unable to afford such efforts. However, three caveats need to be considered:

- First, understanding the various and appropriate sources of funding requires a large and, perhaps, daunting investment on the part of fisheries managers. For example, some funding sources may target sector-specific activities; while others, may target specific issues, such as biodiversity or marine protected areas. Accounting systems and even vocabulary may vary significantly across sources and funding sources may or may not be tied to certain conditions, economic or otherwise.
- Second, as EAF management is likely to comprise both development and conservation components; no one source of funding is likely to cover all EAF needs. Hence, a portfolio approach to funding will be necessary; however this increases the time and energy devoted to developing and using these funds.
- Third, there is a crucial issue of institutional sustainability to consider when utilizing external funds – i.e., ensuring that long-term arrangements are in place so that EAF implementation is not jeopardized when the specific funding period ends.

In recognition of these complexities, guides to finding relevant financing sources have been developed and many of which are freely available on-line; although not

necessarily directed towards fisheries and the EAF. The following guides are focused on conservation and protected areas funding sources. Very importantly, some of these guides provide detailed business planning for marine protected areas and other skills to assist fisheries managers in planning their financial needs assessments and donor funding requests. These guides can be used to enhance the innovation of stakeholders in collective or collaborative financing initiatives to diversify funding sources. Of particular interest may be private-public partnerships that appeal to both foundations and bilateral donors. Perhaps most critically, the guides can be used to suggest feasible options for self-financing and reducing dependence on external funds over the medium to long term.

The major categories of international funding described in these guides are:

- Bilateral & Multilateral donors
- Biodiversity Enterprise Funds,
- Debt for nature/environment swaps,
- Environmental Funds,
- the Global Environmental Facility, and
- Foundations.

A sampling of financing guides available on-line include the following:

- WWF Guides:
  (available at http://www.worldwildlife.org/conservationfinance/)
  Financing Species Conservation
  Financing Marine Conservation: A Menu of Options
  Raising Revenues for Protected Areas
  Center for Conservation Finance Business Plan
  Conservation Finance e-Resources
- Conservation Finance Alliance Guide (with a special focus on marine parks/ reserves):
  http://www.conservationfinance.org/
- Debt for nature/environment swaps guide:
  Debt Swaps for Sustainable Development - A Practical Guide for NGOs
  http://biodiversityeconomics.org/finance/topics-42-00.htm
  Institutions that can support dept swaps
  http://www.undp.org/seed/unso/concepts&programs/pub-htm/swap-eng6.htm
- GEF funds guides:
  The A-Z of the GEF - An NGO Guide to Participation in the GEF
  http://www.gefweb.org/Partners/partners-Nongovernmental_Organ/ngo_guide/ngo_guide.html
- EU funds guide:
  http://www.hbl.lv/engl/esfondi/fondi-zfi.php
  http://ec.europa.eu/comm/fisheries/news_corner/corner_en.htm

Appendices 8.1 and 8.2 provide a first-glance look at the GEF and at "debt for nature" or "debt for environment" swaps. Boxes 18 and 19 include examples of the portfolio approaches to funding used for MPA and coastal resource management.

CONCLUSIONS

Since EAF implies a broadening of attention in fisheries management beyond simply fish stocks and fishing fleets, to matters relating to aquatic ecosystems and related human systems, there is often an assumption that the costs of implementing EAF will be higher than under conventional management. While this is not necessarily the case, certainly there needs to be attention paid to financing the introduction of new approaches. This chapter has accordingly focused on how to make EAF feasible in terms of provision of financing from outside the fishery sector itself – complementing

BOX 18

Coastal resource management financing in the Philippines

Salamanca and Luna (2002) presented an historical perspective of coastal resource management (CRM) in the Philippines and discussed "the factors that are thought to have played crucial roles, the formal institutions that underpin its development, and the issues that need to be addressed for CRM to fully succeed." Within this report and a related background article (Salamanca, 2003), the authors estimated the financial needs and sources of funding for 290 coastal resource management projects and activities from 1974 to 2000. Over this period, approximately US$230 million were spent on activities undertaken to manage the coastal zone and its resources through various implementers (i.e. integrated, multisectoral, government-led, NGO-initiated, and fisherfolk-led) and various focuses (i.e., livelihood, education, research, advocacy, conservation, population, etc.). The authors estimated that approximately US$9 000 per km^2 of coral reef was spent over the sixteen-year period to protect the nation's 26 000 km^2 of reefs.

While studying the financial investments, the authors also investigated the sources of funds and found that 63 percent of the funding came from 44 international sources (i.e. bilateral and multilateral sources, debt for nature swaps, the international NGO community, and international philanthropic organizations); 36 percent from the Filipino government, and one percent from local donors; thus, highlighting the importance of international sources of funding.

Sources: Salamanca and Luna (2002); Salamanca (2003)

BOX. 19

Marine protected area costs and financing in the Mediterranean

In 2006, the World Conservation Union (IUCN) Centre for Mediterranean Cooperation organized the Conference on Sustainable Funding of Protected Areas in the Mediterranean Region. A background document (Lopez Ornat and Jimenez-Cabellero, 2006) was prepared to estimate the costs necessary to "properly" manage marine protected areas in the Mediterranean, the available budgets across the region, the gaps in financing, and potential sources of funds.

Based on the budgets calculated for three marine national parks, four marine reserves, and three high seas fisheries reserves in the Mediterranean, the authors estimated that the costs required for protecting and managing high seas fisheries reserves would range from approximately US$1 to $12/hectare/year; while marine parks and reserves costs would range from $60 to $1 200/ha/yr. The wide ranges derive from differences in size, intensity of protection measures, surveillance and control needs, research activities, and management responsibilities. From these cost estimates, the authors estimated total costs for MPAs in the Mediterranean of approximately $200 million/year to over $600 million/year; one-third of these costs to be borne by non-EU countries. The authors estimated that current public and international sources of funding in the non-EU countries cover only 15 percent of what would be needed to maintain MPAs in their countries.

The authors then proposed a funding strategy that would decrease reliance on governmental budgets and foundation; using international funds in the medium-term; and moving towards market-based funding (e.g. conservation subsidies, concessions and fees, and the tourism sector) in the long run.

Source: Lopez Ornat and Jimenez-Caballero (2006)

the discussions earlier in this report on using incentives and institutions internally in the fishery to support EAF implementation.

The search for EAF financing from outside the fishery that is not only one-time but actually sustainable in nature, is clearly a daunting task. In reviewing the literature on the topic, and drawing on discussions of the Expert Consultation connected with this document, several issues appear, both with regard to the external funding of EAF activities (the focus of this chapter), and more broadly, the balance of incentive-based (internal), governmental, and external funding sources. The following are some of the issues arising:

- Under what circumstances can EAF implementation be self-financing through suitable incentive arrangements? If there is remaining financing needed for EAF implementation, how should the balance of benefits and costs involved in EAF management be reflected in the balancing of sources for this financing?
- If external financing is needed, how do we ensure post-project sustainability once the funding ends? Is this really possible?
- Will basing funding on incremental costs bias projects towards high-technology solutions over low-cost, indigenous solutions?
- How can the environmentally-based projects that are part of EAF implementation properly address poverty issues and other human-oriented goals?
- Given imperfect monitoring and control, how can funds being spent be utilized most effectively? Will success indicators be incorporated automatically into projects to limit "donor fatigue"?
- Since reducing pressure on the fishery resources is a common component of EAF implementation, and this implies a need to shift fishery inputs into other uses, are there enough alternative livelihood possibilities and eco-tourism to go around?

These issues reflect some of the key challenges of EAF management – from the distributional impacts, to use of appropriate technology and management schemes, to the links of fisheries to the broader socio-economic environment and alternative livelihoods. All of these need to be addressed on a case-by-case basis in order to make the implementation of EAF both feasible in the short term and sustainable in the long term.

APPENDIX 8.1
The global environmental facility and the EAF

The institutional structure of GEF

A complete and up-to-date description of the GEF may be found at http://www.gefweb.org/.

In brief, GEF is the financial mechanism for the implementation of four international conventions: the Convention on Biological Diversity; the United Nations Framework Convention on Climate Change; the United Nations Convention to Combat Desertification; and the Stockholm Convention on Persistent Organic Pollutants. The GEF provides grants to pay for the incremental costs (i.e. those beyond status quo or "normal" activities) of implementing these conventions.

The GEF structure follows a mix of the UN Assembly and World Bank Council formats. The Council comprises 32 member countries (generally representing blocks of members), meets twice a year, and is the main governing body, setting policy directions as well as approving any full-size projects. The Assembly is made up of every member states (176), meets four years, and sets the overall priorities of the Facility. The GEF Secretariat, *inter alia*, coordinates all projects and drafts the policies and strategies.

The Implementing Agencies (IA) (i.e. World Bank, UNDP, and UNEP) are responsible for creating project proposals and for managing GEF projects along with the Executing Agencies (e.g. FAO, ADB). Implementing Agencies have direct access to GEF funds (i.e. do not need to pass through another agency to have money), while the Executing Agencies (EA) are moving towards direct access arrangements (e.g. FAO has direct access to GEF project funds in restricted focal areas).

Non-governmental organizations (NGOs) are highly encouraged to participate in GEF activities and assist in the design, execution, and monitoring of projects, although there are certain complications vis-à-vis governments and the national Focal Points.

The Scientific and Technical Advisory Panel (STAP) provides technical advice to the GEF and comprises, *inter alia*, a roster of experts who review full-size project proposals. This roster system is currently under review and may have impacts on fisheries-related projects, depending on the experts chosen to review projects.

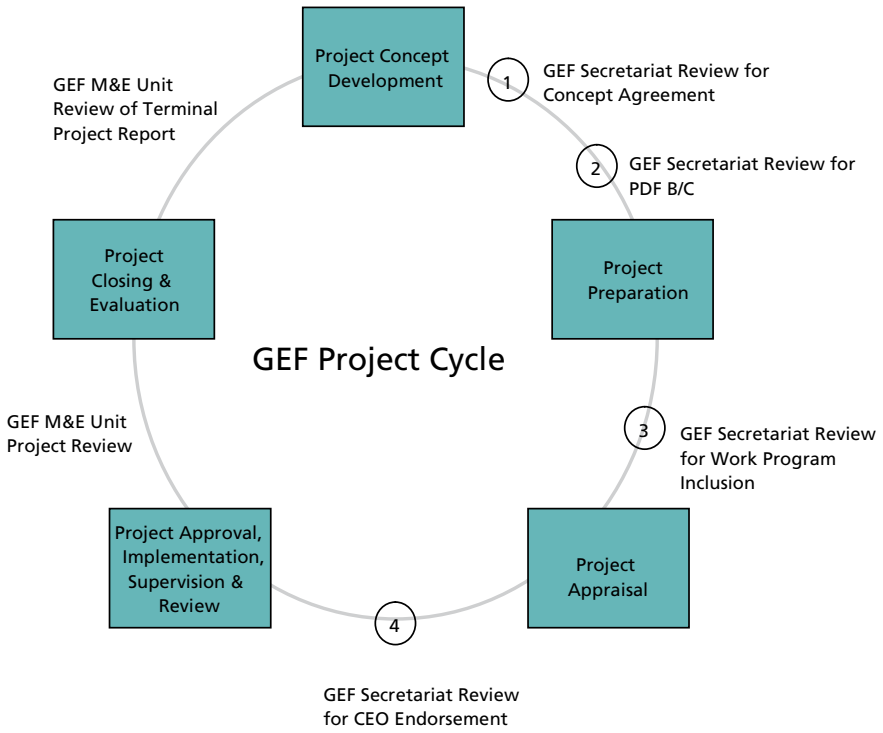
The Monitoring and Evaluation Unit is a detached unit within GEF that conducts evaluations of GEF projects. The last review of GEF itself was conducted by an independent external evaluation firm but the hope is that the M&E Unit would take over this role. The review concluded that some positive environmental impacts could be seen, linked to GEF projects; however, there remained coherency and cohesiveness problems across the portfolios and that there was a need for systematic reporting on indicators to monitor and evaluate GEF projects. The M&E Unit performs an annual review of GEF projects and noted that, on average, the project preparation process lasts three years. This lengthy time frame came up as a major concern repeatedly throughout the familiarization seminar. The GEF Secretariat hopes to improve this time frame in the future and promotes the use of small grants programme (http://sgp.undp.org/), the Development Marketplace Partnership programme, and the Small and Medium Enterprise Programme (http://www.ifc.org/enviro/EFG/GEF-SME-Program/gef-sme-program.htm) to shorten the process (i.e. small sums involved and no Council approval needed).

The GEF project cycles

The following is a graphic presentation of the GEF project cycles for full- and medium-sized projects. The rectangles represent executing/implementing agency input and the circles represent GEF secretariat interventions.

The Project Development Facility funds may be used in the development of a project concept document and include three size categories, leading to a range of project types:

FIGURE 9
The GEF project cycle



- Full-sized Projects (> US$1 million)
- Medium-sized Projects (< US$1 million)
- Enabling Activities under expedited procedures (varies but <US$500 000)
- Small Grants Program (<US$50 000)
- Small and Medium Enterprise (SME) Program.

Incremental costs and co-financing

Incremental cost and co-financing of projects are integral to the idea of GEF; however, they may also be the most difficult to understand or estimate. The official definitions provided by GEF are the following:

Incremental cost - The additional cost that the GEF funds between the cost of an alternative project that a country would have implemented in the absence of global environmental concerns, and a project undertaken with global objectives in mind.

Co-financing - Non-GEF resources committed to a project. Sources of co-financing include implementing agencies, other bilateral or international funding agencies, recipient countries, NGOs, and the private sector.

It is well advised to review existing GEF project documents for examples relating to fisheries and the EAF. One example relating to incremental costs analysis from a GEF-financed project on conservation and sustainable use of the Belize barrier reef complex and a spread-sheet example for co-financing calculations (UNEP budget sample) may be found at http://dgef.unep.org/kc/refmanuals/.

Advantages and disadvantages of GEF funding

As is the case with all funding sources, planners should understand the pros and cons before investing in processes. The Conservation Finance Alliance Guide offers the following list for consideration:

Advantages	Disadvantages
The GEF is an important source of large-scale grant funding.	Can take a long time (three years or more) and significant commitment of resources to secure funding, particularly for full-size projects.
The GEF structure, grant selection process, and portfolio is publicly accessible. Information on all past and present projects can be found on the GEF web site.	The diverse range of actors involved in the project cycle can make project approval a complex process.
The GEF seeks to "mainstream" global biodiversity concerns into the regular project portfolios of the three IAs.	Project proponents must learn to successfully negotiate complex project development procedures of IAs.
The GEF funds a wide variety of institutions, including governments, NGOs, and the private sector. In particular, the GEF has become an important source to support NGO-led conservation projects.	Only incremental costs related to realizing global biodiversity benefits are funded directly.
GEF has been the major funder of Conservation Trust Funds (see chapter on CTFs).	Short funding cycle limits potential to achieve financial sustainability.
GEF provides funding to support other innovative finance mechanisms, such as environmental investment funds, and is currently examining other innovative opportunities for deploying its capital.	

GEF fisheries-related projects

Past, current, and pipeline fisheries- and aquatic resources- related projects mainly fall within the Biodiversity and International Waters focal areas of GEF. A list of GEF co-funded projects relating to EAF is available through the GEF project database: http://gefonline.org/home.cfm. Note that experiences may be gained from non-fisheries projects, such as those touching on community-based integrated terrestrial ecosystem management.

APPENDIX 8.2
Debt-for-nature swaps – how they work

The following text is taken directly from Resor (1997). Another interesting article on debt-for-nature swaps and protected areas is Thapa and Sasidharan (2003).

A debt-for-nature swap involves purchasing foreign debt, converting that debt into local currency and using the proceeds to fund conservation activities. The key to the transaction lies in the willingness of commercial banks (or governments) to sell debt at less than the full value of the original loan. This seems counterintuitive: why would any lending institution holding a promissory note for US$1 million, for instance, be willing to part with it for just half that amount? The answer lies in the hard economic fact that many developing countries have not been able to repay their debts in full, and may never be able to do so. As a result, commercial banks may prefer to sell debts at a discount rather than wait for an uncertain repayment in the future.

While no two debt-for-nature swaps are the same, they usually include the following steps:

1. An indebted country establishes general guidelines for a debt-for-nature programme and invites participation from conservation organizations.
2. An international conservation organization and local private and public organizations reach agreement on a conservation programme.
3. The participating conservation organizations verify that sufficient funding will exist for the debt purchase or that debt donations or partial forgiveness may be possible.
4. The partners request government approval for the swap, usually from the central bank and the Ministry of Finance, and often from the government ministry that has jurisdiction over the relevant sector where the proceeds will be used.
5. Specific terms of the swap are negotiated, including the exchange rate from foreign currency to local currency, the redemption rate and the local investment instrument. The purchase price depends on the secondary market price of the debt, which is determined by the market's view of the credit history and repayment expectations for the particular country. The amount of conservation funds generated depends on the redemption rate, which is the percentage of the face value debt that is redeemed in local currency. The redemption rate is sometimes 100 percent of the face value debt, but it is often less depending on negotiations among the parties involved. The redemption rate must exceed the purchase price of the debt by a large enough margin to make the transaction worth while.
6. The debt is acquired and is presented to the central bank of the indebted country which cancels the debt and provides funds in local currency, either in the form of cash or bonds.
7. The conservation projects are implemented over the life of the agreed programme.

9. Synthesis and final observations

SUMMING UP

In fisheries worldwide, the ecosystem approach has been increasingly accepted as a key "vehicle" for developing and improving fisheries management. Reflecting this direction, the FAO published in 2003 its Technical Guidelines on the Ecosystem Approach to Fisheries (EAF). Those guidelines, in defining what is meant by the EAF, focus on aspects within the ability of fisheries management bodies to implement, while recognizing the fisheries sector's responsibility to collaborate in a broader multisectoral application of the EA. That definition lays out a bold vision for the EAF:

> *an ecosystem approach to fisheries (EAF) strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries*

This makes clear that implementation of the EAF is a human pursuit, taking place in the context of societal and/or community objectives, which inherently reflect human aspirations and values. Thus to be successful in an EAF process, the social and economic forces at play need to be understood, the incentives and disincentives driving human behaviour need to be investigated, and actions need to be undertaken in terms of fishery governance and corresponding institutional arrangements. All this is needed so that management can induce outcomes in the fishery compatible with societal objectives, by managing a range of human interactions with the fishery ecosystem, whether technical, economic, social or institutional. Furthermore, an ecosystem approach, even if focusing on the fisheries sector, must deal to some extent with interactions with other uses of the aquatic environment; it is bound to lead into interactions with multiple sectors of human activity beyond the fishery.

Indeed, adoption of EAF management will, on the one hand, ensure that we take into account impacts of the larger system (the ecosystem and relevant human elements) on fishery management, and at the same time, ensure that the broader consequences of management actions are assessed. The EAF deals with the "bigger picture" around fisheries, specifically to allow us to encompass relevant factors affecting and interacting with management from across the fishery system and beyond. EAF management (1) looks at managing target fish species and fishing activity within the context of the ecosystem, (2) looks at the fishery within a larger context of households, communities and the socio-economic environment and (3) considers fishery management in a broader institutional context of managing multiple resource uses.

Given this, the need to understand the human components of the fishery system in implementing an ecosystem approach is clear, as humans are part of, depend on, and affect the ecosystem in which they live, work, and play. The challenge lies in implementation.

This report has attempted to provide support in meeting that challenge, by building on the EAF Guidelines, providing a focus on the human dimensions (i.e. political, legal, cultural, social, economic and institutional aspects). Grounded in the belief that the application of the EAF must be holistic, integrated, participatory, and adaptive, the report has consolidated a range of available knowledge and experience relevant to EAF implementation, from social, economic and institutional viewpoints, and examined the manner by which these aspects can be practically incorporated, as well as highlighting the remaining gaps in both knowledge and implementation. The report has covered

a wide range of topics – indeed, seeking to provide an overview of as many major topics as possible, rather than a comprehensive treatment of any one topic, and yet we recognize that not all possible topics were dealt with here. Furthermore, no topic was dealt with fully, as we sought a widely-accessible level of discussion rather than a detailed state-of-the-art one.

The first part of the report focused on the human context for an ecosystem approach to fisheries, with introductory and background material essential to understand prior to embarking on EAF initiatives. This began with coverage of key concepts and issues, discussion of social, economic and institutional considerations involved in EAF, and links of EAF to two other major approaches related to fisheries, namely the livelihoods approach and integrated management. This was followed by an exploration of the many values humans place on ecosystems, including the value of such ecosystem services to human well-being – socially, culturally and economically – and how an understanding of these values can help in implementing EAF. The final two chapters of Part I examined a series of policy, legal and institutional frameworks (such as the Millennium Development Goals, the precautionary approach and co-management approaches) as well as social and economic considerations (such as employment and livelihoods, poverty, food security, traditional knowledge and distributional aspects).

Part II of the report moved into aspects related to facilitating the implementation of EAF. Initial steps include the setting of appropriate boundaries, scale and scope for EAF implementation, as well as assessing, *a priori*, the impacts resulting from EAF management in terms of potential benefits and costs, from social, economic, ecological and management perspectives. Relevant here are decision-making tools for assessing EAF, such as cost-benefit analysis, indicator frameworks and bio-economic models. For sustainable and effective EAF management, it is crucial to create and/or utilize incentive mechanisms and institutional arrangements for promoting, facilitating and funding the EAF; the report examined various forms of these – institutional, legal, financial and social incentives. Finally, in exploring the implementation of EAF, the matter of external (non-fisheries) financing was examined – through means such as "polluter pays" and external conservation financing, including debt-for-nature swaps.

KEY ASPECTS

In seeking to address the context, tools and methods relating to human dimensions of the EAF, this report has covered a great deal of ground. It would be impossible to sum up all the messages coming from this analysis, but the following are three key aspects one might keep in mind in moving forward with EAF implementation:

Entry points

Human dimensions – social, economic and institutional – can be simultaneously drivers, constraints, and/or supports for EAF implementation, and in addition, there can be social, economic and institutional impacts of that implementation. In other words, the human considerations crucial to the ecosystem approach to fisheries can be approached through four major "entry points":

- social, economic and institutional factors are often driving forces, *motivations* behind the need for and the move to EAF management – drivers may be at any scale (from local to international), and could range from international treaty obligations, to crises and conflicts within the fisheries, to adoption of a future framework for achieving sustainable development;
- the potential costs and benefits to individuals and society of applying the EAF will have social, economic and management components, as well as ecological ones – and since there are many choices to be made in applying an EAF, there will be tradeoffs related to each alternative, so it is important to assess the benefits and costs of each option;

- social, economic and institutional instruments are all useful in the application of EAF, and in particular these arise in terms of the institutions utilized within EAF management and the incentives that are created or drawn upon for EAF adoption; and
- social, economic and institutional factors can all play roles in supporting or constraining the implementation of EAF management – these can include power and governance structures, economic "push" and "pull" mechanisms driving fishing activities, sociocultural values and norms associated with fishing, and external contexts (e.g. global markets and political changes) that have an impact on fisheries.

Human realities

As noted at the beginning of this report, the EAF needs to incorporate the human (and ecosystem) considerations that have a clear interaction with fisheries management, i.e. which will typically need to be taken into account for effective fisheries management. To this end, three human-oriented realities must be taken into account in the implementation of an EAF:

- First, EAF must take place in the context of societal and/or community objectives, which inherently reflect human aspirations and values.
- Second, as EAF takes into account interactions between fisheries and ecosystems, this includes a wide range of complexities relating to human behaviour, human decision making, human use of resources, and so on.
- Third, *implementing* the EAF is a human pursuit, with implications in terms of the institutional arrangements that are needed, the social and economic forces at play, and the carrots (incentives) and sticks (e.g. penalties) that can induce actions compatible with societal objectives.

The importance of policy, institutions and incentives

The ecosystem approach to fisheries can be operationalized at very concrete levels, such as measures to reduce bycatch or to reduce impacts of fisheries on the ocean habitat. These can be important and immediate measures to improve ecosystem health. At the same time, however, it is crucial to look at a broader picture in the fishery – at how policy is formulated, how institutions are functioning, and how incentives move the fishery in a desired or undesirable direction.

Consideration of policy and institutional aspects highlight the need in EAF for structured decision-making processes, grounded in the accepted set of societal objectives, and governed by a suitable set of operating principles. Fishery objectives underlie the criteria for judging success, while principles influence the choices made of policy and management measures to best meet the stated objectives. These are drawn from many sources, such as national legislation, international conventions, and "approaches" including the precautionary approach and the ecosystem approach.

In implementing the EAF, each jurisdiction or community must weigh its options and choose what is considered the best direction, to meet objectives in a manner compatible with principles. This effort will involve making trade-offs (e.g. between socio-cultural, ecological and economic objectives) and taking into account the possibilities for cooperation (or conflict) with other jurisdictions/communities.

In considering EAF policy, it is important to note that this can be developed at multiple scales, from the international to the national, district or local scales. Governance must be "nested" across these various scales, as well as being linked across sectors, i.e. connecting the fishery to other components of aquatic use, recognizing that other national policies (beyond fisheries) also relate to ecosystems.

With respect to institutions for EAF, these can be formal (e.g. governmental), informal (e.g. based on community cultural systems) or economic (e.g. markets). A

fundamental requirement is legitimacy of the institutions, notably whether they are seen to be fair and transparent, with suitable participation of those affected. In the latter regard, co-management and community-based management can be key policy directions, where appropriate. This leads into the key question of who is or should be involved in the EAF policy domain. There will likely be more players than is typically the case in conventional fisheries management, particularly when EAF examines aspects that cross sectoral lines. Indeed, there will eventually need to be linkages beyond fisheries to multisectoral institutions, to assess the impacts of interactions and cumulative impacts, while developing cohesive and integrated policy, e.g. in a context of integrated coastal and ocean management

Finally, with respect to incentives, the report has emphasized that these can come in many forms, from legal to social and cultural, to economic and financial. The key challenge is to create or reinforce incentives that shift human behaviour in a way that supports the goals of the EAF. To accomplish this, clearly one needs to know not only what instruments can be utilized, but also how people are likely to respond to those measures. In other words, it is not enough to simply promote incentives as a tool for EAF – one must understand both the tools available and the context of the fishery. There is no single answer to the question of incentives: for example, fishing use rights systems are often advocated as a means to provide suitable incentives, but many choices are to be made in this regard, such as those between individual rights or community rights, and between various co-management systems. One needs to assess the objectives, the principles being followed, and the context of the fishery and its broader environment, in order to make wise choices in this regard.

INFORMATION NEEDS FOR DECISION-MAKING

A major factor inhibiting the adoption and implementation of EAF management is a sense that the information requirements are simply too great for it to be feasible. After all, if an adoption of the ecosystem approach in a given fishery requires a deep understanding of the related ecosystem, how many fisheries around the world would be ready? In a data-sparse fishery, it might be argued that while the EAF may be suitable in better-studied or wealthier fisheries, it could not work in a fishery with a limited knowledge base. However, in the well-studied and heavily-managed fishery, it can still be felt that the knowledge of the ecosystem is insufficient for EAF implementation. In other words, every fishery might be considered lacking in information needed for the EAF.

So how much and what kind of information is really required to implement and sustain EAF? It is important to recognize that the EAF is an "approach" not a set-in-stone methodology that must be applied in an all-or-nothing manner. The "toolkit" described in this report, and the material found in the various fisheries management and EAF guidelines, can be utilized on any scale (e.g. from a local community fishery to a national or regional scale) and to any extent, from a small incremental move beyond conventional management through to a wide-ranging and comprehensive implementation. For example, a modest focus on dealing with bycatch issues, rather than all multispecies interactions, in a given fishery, or a pilot project to look at EAF management in a local bay, rather than a whole nation, both reflect less data-intensive and indeed less expensive means to progress on EAF management.

Specifically in the case of developing countries, applications of the EAF that are low in data needs may be most appropriate. For example, instead of demanding extensive quantitative measurements of each relevant factor, it can be possible to work with checklists based on qualitative assessments. The more limited is the information base, the more important is the idea of a "risk analysis" that focuses, for example, not on calculating precise fish stock predictions, but rather on assessing the risks inherent in each scenario being considered. This is very much in the spirit of the precautionary approach: taking action on conservation decisions despite the uncertainties being faced,

and lacking the information that would be preferred. The question becomes: in the face of many uncertainties, and with various choices available in terms of management actions, what level of risk is society willing to accept, and what does this tell us about the management choice?

Of course, over time, there will be a need for research within EAF management. This can be carried out with a multidisciplinary approach, to connect and integrate the analyses of the various scientists into a single management model, reconciling the various underlying assumptions, perspectives, and biases. Such an approach is preferred over having those studies independent of and divergent from one another, in which case there is a risk that managers will miss the overall message. To this end, a multidisciplinary team approach to research and analysis can be effective. For example, sociologists and anthropologists can identify the relevant groups in a community and their goals and objectives. Biologists can develop the stock dynamics affecting production. Economists can provide a framework for integrating these different results into a cohesive model. These and other necessary fields can be used to develop a single set of outcomes from an assessment of management alternatives.

CLOSING COMMENTS

In recognizing that the EAF is indeed an "approach" rather than a strict recipe to be followed, and can be either costly or inexpensive depending on the extent of its implementation, it becomes clear that an ecosystem approach, to some extent, is indeed appropriate for adoption in every fishery. While some fisheries may embark on a major shift to EAF management, changing processes from data collection through to institutional design, in other fisheries (notably data-sparse small-scale fisheries), a low-cost EAF implementation that is less demanding of financial and human resources will be more suitable. The key point is that the EAF "way of thinking" can be adopted in all cases.

What is crucial, however, is to realize that the various human dimensions – the social, economic and institutional aspects – will vary from fishery to fishery. While information on these may be limited, they need to be taken into account as much as possible, right from the start, so EAF implementation can proceed in a feasible and effective direction. Furthermore, on an ongoing basis, use of adaptive management and learning processes, to build and improve EAF over time, can allow EAF systems to adjust over time, as new experiences and new knowledge become available.

It is worth noting in conclusion that there has been some progress in meeting the challenge of EAF implementation, both in terms of moving towards an improved understanding of social, economic and institutional aspects relating to fishery management (and EAF in particular), and in terms of developing tools and instruments to improve management by taking this understanding into account. As noted earlier, efforts of countries to address aspects of EAF have arisen in three main categories:

- Issue-based technically-oriented actions, such as reducing bycatch, increasing gear selectivity, reducing harmful impacts of fishing gear, and protecting and restoring critical habitats;
- Implementation of institutional changes as part of national EAF measures, such as increasing stakeholder involvement in fisheries management, creating multidisciplinary and/or intersectoral advisory committees, and using community-based management tools; and
- Broadening national information systems to include factors such as ecosystem models, multidisciplinary information in risk assessments and cost-benefit analyses, local and/or traditional knowledge, and participatory information systems.

There is much still to be done globally to bring the human dimensions more fully into consideration in implementing EAF management. Nevertheless, there have

been many moves in this direction, and the momentum is building – with the clear recognition that a better understanding and incorporation of the "people side" is crucial to EAF implementation in fisheries worldwide.

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ANNEX

Process-oriented methodologies and information management tools for use in EAF implementation

Prepared by Patrick McConney with Merle Sowman, Cassandra De Young and Anthony Charles

This Annex describes some of the methods and tools commonly used to:

- ensure that policy and planning processes run smoothly;
- acquire the information that is needed for these processes.

To assist the reader in determining what tools or methods could be used in developing or implementing various aspects of the EAF, we pose for each of them three questions:

- "What is the nature of the method or tool?"
- "Why is it important?"
- "How is it used in EAF?"

The space here to answer these questions is limited. In each case there is a body of literature that provides background to the method or tool, describes appropriate use in greater detail and reviews application in various situations. Readers are advised to consult this literature for further information and guidance.

This Annex is organized into two parts, on process-oriented and information gathering methodologies and tools. Within each of the two sections in this annex, the methods and tools are presented in alphabetical order. Some apply more to large-scale situations, such as a large marine ecosystem, while others are more appropriate for local or community levels. Many of them are interdisciplinary to lesser or greater extents, but some are more akin to generic skills than any particular academic discipline.

It is tempting, but potentially misleading, to categorize them as low or high cost. Inexpensive methods may become costly when aggregated over large geographic areas, numbers of sampling units, or other factors of scale and scope. Several methods complement each other, such that they can operate in parallel, be nested within others or allow others to be nested within them. Readers are advised to determine the mix of methods and tools that fit the given context, including the capacity to use them successfully, rather than to seek a neat hierarchy or blueprint for selecting or applying them.

The methods and tools presented in this Annex are not exhaustive. Additional methods and tools exist which may be equally appropriate in the many different situations in which EAF may be applied. The references and descriptions serve only as starting points for seeking the most appropriate from among the many options.

PROCESS METHODOLOGIES

Process methodologies are the sets of skills and mechanisms used to efficiently and effectively implement policy, planning and management activities that involve groups of people interacting, often in decision-making. They provide structured approaches to reaching desired outcomes.

Conflict management and negotiation

What is it?

The goal of conflict management is not to avoid conflict, but to apply skills that can help people to express their differences and solve their problems for win-win, or mutually beneficial, outcomes (McConney *et al.*, 2003). Conflict management is facilitated negotiation that works best under the following conditions:

- All the disputing parties are known
- Willingness to negotiate resolution
- Reaching resolution is important for all
- Parties trust conflict management method
- A mutually beneficial outcome is a possibility
- Parties have authority to make deals
- Funds, time and other resources are available
- Resolution is desirable in the wider context

Why is it important?

Conflicts are almost inevitable in multistakeholder situations such as EAF, and they are not necessarily negative. They may cause more equitable power relationships to emerge, correct bad fisheries management practices or improve EAF policy. The issue is how to manage conflicts in order to reach (at least temporary) solutions in the most appropriate and least disruptive or harmful manner.

How is it used in EAF?

It is useful at many points in policy and planning cycles, and management as well, to reduce the actual or potential levels of conflict amongst diverse stakeholders so that decision processes can be more positive and productive. Being social interactions, conflicts have many dimensions that should be properly understood before interventions are made, and this necessitates human dimensions research. Often there will be more than one source of conflict. Correct identification of the nature of the source of the conflict requires getting past the symptoms until the root cause(s) are reached. Potential sources of conflict include:

- Relationships – values, beliefs, prejudices, past injustices, poor communication
- Information – poor quality information, misinformation, differing interpretations
- Interests – perceived or actual; substantive/physical or intangible/perceptual
- Structures – institutions, authority, resource flows, time constraints, financing

There are several stages in conflict management. The following apply to most methods:

- Initiation – a stakeholder or outsider invites help to manage the conflict
- Preparation – conflict analysis, information sharing, rules, participant selection
- Negotiation – articulating interests and win-win options, packaging desired options
- Agreement – concluding jointly on best option package, recording final decisions
- Implementation – publicizing outcomes, signed agreement (optional), monitoring

In the highly technical situations common in EAF negotiations, there may be serious disparities in the capacities of stakeholder groups to interpret and use the information provided. In such situations it may be necessary, as part of the process, to allocate specialist expertise to groups in need. Mutually beneficial outcomes can usually only be realised if participants progress from negotiating on the basis of positions to negotiating in keeping with their underlying interests (Fisher *et al.*, 1981). Positions may change, but interests are likely to remain the same, or be modified upon understanding the interests of the other side(s).

Consensus building

What is it?

Closely related to conflict management, consensus building is the term used for a number of collaborative decision-making techniques in which a facilitator or mediator assists diverse or competing interest groups to agree on contentious policy issues, management objectives, or other matters for which consensus rather than majority decisions are being pursued. Visioning and collaborative problem solving are examples of consensus processes (Susskind *et al*., 1999). Consensus building tends to be a fairly informal, but structured, process for discussing issues and sharing perspectives while respecting interests and seeking ways of working together for mutual benefit.

Why is it important?

Similar to conflict management, consensus building plays an important role in helping decision processes to be more positive and productive. It can be employed prior to a conflict developing and hence reducing the need for conflict management. It is often essential to reach consensus rather than a majority decision when the dissenters have the power to thwart the decision that they disagree with, or to instigate and fuel levels of conflict that de-rail the process.

How is it used in EAF?

In EAF, consensus building is especially important at the levels of policy goals and plan objectives where reaching harmonious agreement on big issues paves the way for subsidiary agreements on numerous smaller technical and institutional issues. For example, an agreement on how agricultural and fisheries development should mesh with tourism may set the stage for comprehensive watershed and coastal management encompassing both terrestrial and aquatic ecosystems. Without consensus at a higher policy level on how these economic sectors are either related or integrated, using and interpreting sectoral performance indicators could be difficult.

Delphi method

What is it?

The city of Delphi was where people came to consult the oracle housed in Apollo's temple who forecasted the future. The purpose of the Delphi technique is to elicit information and judgments from a group to facilitate problem-solving, forecasting, planning, and decision-making (Neuman, 1994). It often involves paneling a group of experts on a particular topic to determine consensus on an issue. This method is used both for information acquisition and in process.

Why is it important?

There are many variations of the Delphi method, and while some can be used in face-to-face meetings, most seek to avoid physically assembling the experts. Instead, information is exchanged via email these days. This takes advantage of experts' creativity while facilitating group involvement and interaction. Delphi is designed to reap the benefits, but reduce the liabilities, of group problem-solving. This is important in EAF because ordinary meetings of diverse experts with different disciplinary backgrounds and academic or professional status can be difficult to manage even with a facilitator. Such meetings are expensive to organize if the experts reside in different corners of the world.

How is it used in EAF?

The Delphi technique can be used in the EAF to overcome many of the constraints associated with getting the best available scientific advice in the most cost-effective and efficient manner (Landeta, 2006). If, for example, expert opinion were required on

some aspect of ecosystem interactions at a particular site, a panel of carefully selected experts would be assigned to answer a series of questionnaires in which the questions are usually formulated as hypotheses or propositions. Each round of questioning is followed with the feedback on the preceding round of replies, usually presented anonymously. Thus the experts are encouraged to revise their earlier answers in light of the replies of other members of the group. During this process the range of the answers will normally decrease, and the group will converge towards consensus. After three or four rounds the process is usually complete and the median scores determine the final outcome that reflects the best available advice from the group. Software is available to support the Delphi technique. It can be used at several points in policy, planning and management cycles.

Facilitation

What is it?

As a critical supporting skill in SEI research with human subjects, facilitation helps exchanges, meetings or decision-making to run smoothly and reach desirable ends. Facilitation, by itself, does not mean problem-solving. The role of the facilitator is not to control a group or make the final decision on anything. The facilitator is trained to be responsible for ensuring that group processes are inclusive, productive, and effective.

Why is it important?

Many of the policy and management planning processes in EAF involve groups of diverse stakeholders trying to resolve conflicts or reach decisions. It is useful to have a trained facilitator guide participants, and so reduce claims of lack of objectivity or transparency (McConney *et al*., 2003). The facilitator should have a feel for the social, cultural and institutional landscape, and possess the skills to work with diverse groups of stakeholders and under sometimes very difficult circumstances, such as when there is conflict. The skills and abilities are different to those of a chairman.

How is it used in EAF?

It is used in all processes, such as a group of resource users, fishery and coastal managers, interests from outside the fisheries sector and environmental NGOs trying to decide upon management or policy objectives at a national workshop. However, facilitation skills are also useful on the beach with a group of fishers in the midst of an argument with watersports operators about the use of coastal areas. The opportunities for use in EAF are numerous given the several groups involved. It is important to have a trained facilitator, who:

- Distinguishes process from content
- Manages the client relationship
- Prepares thoroughly for planning
- Uses time and space intentionally
- Evokes participation and creativity
- Maintains objectivity at all times
- Reads underlying group dynamics
- Releases blocks to the process
- Adapts to the changing situation
- Shares responsibility for process
- Demonstrates professionalism
- Shows confidence and authenticity
- Maintains personal integrity

Visioning

What is it?

Visioning is a group exercise, often used in the initial stages of strategic planning and other goal-oriented processes, to define and communicate to create a sense of shared ownership a desirable future.

Why is it important?

It is important for stakeholders to actually see the end point of their efforts and not only a path that may lead to it. The more stakeholders there are, the more important it is to share a vision early in the process.

How is it used in EAF?

Visioning provides a frame or reference for strategizing the outcome that EAF stakeholders want to achieve. Vividly describing and then agreeing upon the conditions of the future as if they could be seen in the present, makes easier to devise the path (through mission, goals, objectives, activities and tasks).

INFORMATION ACQUISITION AND DISSEMINATION

Information acquisition covers a variety of means of collecting and converting data into information. It is often the first step in policy and planning processes such as those described above. Information dissemination or communication is a similarly multifaceted term used to describe means of communication to diverse audiences, often by several channels, pathways and products (FAO, 2006b). Some agencies go a step further beyond outputs to address information uptake and knowledge mobilization such as to produce management or policy outcomes.

Asset mapping

What is it?

An asset map is typically an inventory of the features and relationships of a community as perceived by the people in that community (Guy *et al.*, 2002). Mapping assets involves:

- collecting an inventory of positive aspects of a community
- ranking aspects of the community valued the most by members
- determining why people place high value on certain assets in the community

Why is it important?

Asset mapping provides a shared community view of what are the important assets of the entire community, highlighting interconnections among assets and revealing how to access those assets such as for use in livelihood or coping or community development strategies.

How is it used in EAF?

An asset map can be used to devise collaborative strategize about how to build on assets in order to sustain and enhance community development. The process is often one of empowerment and reveals the relationships that communities have with ecosystems.

Brainstorming

What is it?

Brainstorming is process for creatively generating many alternative ideas or solutions for a specific topic or problem. It can be used by individuals, but is often a group process. After ideas are generated they are often categorized, discussed and prioritized for further analysis.

Why is it important?
Good brainstorming exercises can produce very innovative ideas or solutions. It is an equitable method in that any person can participate. Criticism is not allowed during brainstorming and this free flowing participation can also be useful for building teamwork.

How is it used in EAF?
Employed mainly in planning processes, brainstorming can quickly generate a series of objectives and activities for closer examination afterwards. If the stakeholders are diverse the mix of ideas can be quite varied. The best ideas, "outside of the box", may come from those who are not experts.

Communication strategy

What is it?
A communication strategy is a summary framework that sets out, often in a matrix or table, the key elements and relationships of any initiative to share information to achieve expected outcomes. Elements typically include target audiences, objectives, key messages, products and pathways with appropriate budgets.

Why is it important?
Unless a strategy is devised, it is likely that simply disseminating information (such as in technical reports or scientific articles) will result in key audiences (e.g. policy-makers, resource users) being overlooked or not communicated with effectively. It is important to ensure that key stakeholder groups are kept informed of progress and problems with the EAF.

How is it used in EAF?
Especially during the early introduction of an EAF it will be necessary to keep all stakeholders well informed, and information will need to be packaged in different ways to meet the needs of different audiences. Using a communication strategy will assist in clearly setting out who needs what information in what form, and facilitate budgeting for it rather than leaving communication as an afterthought. Monitoring and evaluating communication outcomes can be part of a participatory strategy to keep stakeholders involved.

Focus groups

What is it?
Focus groups are an interactive form of group interviewing. Group interviewing involves interviewing a number of people at the same time, the emphasis being on questions and responses between the researcher and participants. Focus groups however rely on interaction within the group based on topics that are supplied by the researcher (Morgan, 1997).

Why is it important?
The focus group is important in providing a means of collecting data that more closely resembles daily interactive conversation and information sharing than the standard individual interview, especially in some cultures. Often a focus group may be the best way to solicit information when, for a variety of reasons, respondents may be reluctant to participate in individual surveys. Unlike the latter or simple group interviews, focus groups encourage the respondents to react to each other, share knowledge, trade opinions and so on, all without the obligation to reach a group decision or consensus.

How is it used in EAF?

In EAF it may be useful to have a variety of stakeholders that meet the basic focus group criteria for respondent selection gather to answer questions concerning, for example, the multiple uses of a particular reef or estuary. They may have very different views that will be revealed in the focus group session without the need for a "correct" answer or to achieve consensus.

Institutional analysis

What is it?

Institutional analysis is the investigation of how formal and informal social rules (institutions) shape human behaviour. Institutional analyses focus on how individuals and groups construct institutions, how institutions operate by patterns of interaction, how they are linked and the outcomes generated by institutions. As an example of institutional analysis the International Centre for Living Aquatic Resources Management (ICLARM) and Institute for Fisheries Management and Coastal Community Development (IFM) (ICLARM and IFM, 1998) developed a methodology for institutional analysis that has been employed particularly for research into co-management arrangements and conditions for success (Figure Annex 1).

The set of contextual variables shown on the left describe the fishery system that, influenced by external factors, results in incentives for fishery actors to interact or not in various patterns that have observable outcomes which feedback into the system that is constantly adapting.

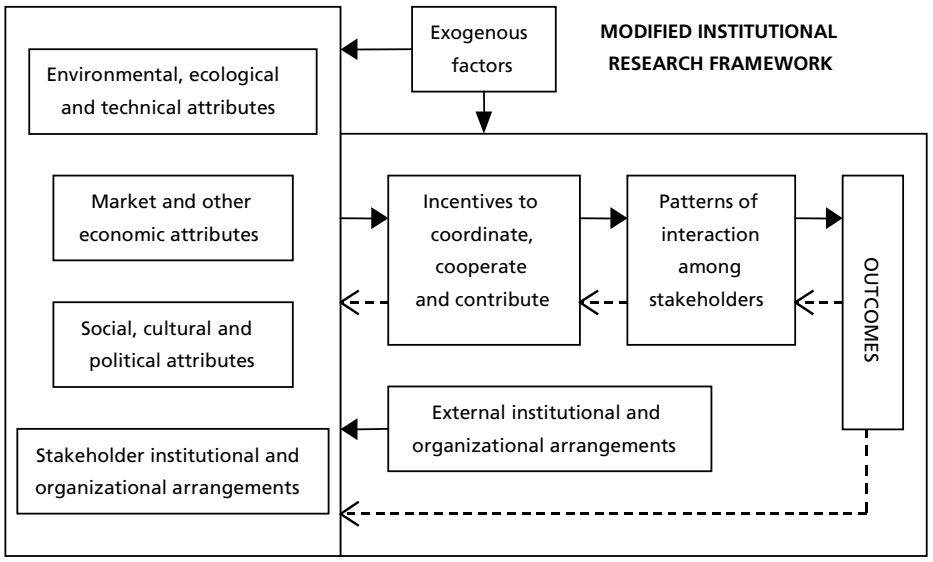
Why is it important?

Without institutional analysis a clear understanding of the complex interactions and relationships among the actors in fisheries is not likely to be achieved. This understanding is even more important as EAF encompasses a greater number of actors including those in other sectors.

How is it used in EAF?

It is used in EAF to determine what institutions are involved in policy, planning and implementation within the contexts of the key attributes of the fishery system. It

FIGURE ANNEX 1
Modified ICLARM/IFM Institutional Analysis and Design Research Framework



allows interventions to be designed, monitored and evaluated in a systematic fashion that facilitates learning and adaptation. The main aspects of institutional analysis conducted within the framework introduced above for investigating co-management are as follows (ICLARM and IFM, 1998).

- Institutional arrangements analysis: This links the contextual variables that characterize key attributes of the resource and the resource users with management institutions (fishery rights and rules). These arrangements and contexts affect how resource users and fisheries authorities use incentives and penalties to coordinate and cooperate in resource governance, management and use. Incentives influence the patterns of interaction and behaviour of the co-management partners, i.e. the type of co-management arrangement and how it functions.
- Co-management performance analysis: The co-management produces outcomes that feedback to impact upon contexts and the behaviour of all stakeholders including fisheries authorities. Contexts that change over time may change institutional arrangements. These affect incentives, patterns of interaction and outcomes. Co-management outcomes can be evaluated in terms of management efficiency, and the equity and sustainability of resource utilization. Analysing successful outcomes is particularly useful for learning and adapting.

Participatory monitoring and evaluation

What is it?

Participatory monitoring and evaluation (PM&E) involves the assessment of change throughout processes that involve many people or groups, each of whom is affecting or affected by the impacts being assessed. Negotiation leads to agreement on how progress should be measured and the findings acted upon. It is a challenging process for all concerned as different stakeholders must examine their assumptions about what constitutes progress – and together deal with the contradictions and conflicts that can emerge (Guijt, 1999).

Why is it important?

It promotes transparency and accountability while ensuring that the stakeholders and beneficiaries are fully engaged in the initiative. Where there are significant differences in the perspectives or backgrounds of participants it allows for information exchange focused on assessment in a way that may, by its objectivity, facilitate consensus building.

How is it used in EAF?

Within the policy and planning cycles PM&E can be used throughout implementation or at particular milestones to assess progress particularly prior to taking decisions on adaptive management action. It is one of the methods that fosters institutional and social learning and can contribute towards stakeholder empowerment.

Poverty assessment

What is it?

Poverty assessment encompasses a diverse suite of tools used to measure the complex multidimensional attributed of the state of relative deprivation defined in various ways as poverty with reference to a standard such as the "poverty line". The assessment tools address matters of income, nutrition, health, power, services and other aspects of quality of life, with areas of emphasis and approach (e.g. participatory or not) often depending on the method, purpose and agency doing the assessment.

Why is it important?
Poverty assessments have become particularly in the context of the Millennium Development Goals (MDGs) and the relationships between poverty and ecosystems described in the Millennium Ecosystem Assessment (MA).

How is it used in EAF?
In an EAF poverty assessments can facilitate the development of pro-poor policies and measures that help to alleviate poverty. They elucidate the conditions and underpinnings of poverty associated with particular ecosystems, locations and sectors of society. The poor or aspects of poverty may be overlooked in conventional fisheries management or approaches that do not encompass the human dimensions.

Rapid and participatory rural appraisals

What is it?
Rapid rural appraisal (RRA) emphasizes the importance of learning rapidly and directly from people. RRA involves tapping local knowledge and gaining information and insight from local people using a range of interactive tools and methods (Jackson and Ingles, 1995). Participatory rural appraisal (PRA) involves field workers learning with local people with the aim of facilitating local capacity to analyse, plan, resolve conflicts, take action and monitor and evaluate according to a local agenda.

Why is it important?
RRA is regarded as a set of guidelines and tools which can be used in many different ways and many different circumstances and without necessarily attempting to change political and social structures. PRA is the specific use of RRA approaches and tools to encourage participation in decision-making and planning by people who are usually excluded from these processes. RRA is a useful technique for data gathering and problem identification, whereas PRA is more appropriate to programme design and planning. The distinction is not merely one of proper sequencing. If not used correctly, PRA can generate false expectations of what the programme will provide or what local people can achieve. This can cause problems in the relationship between the community members and the programme staff which can threaten success. Both approaches are carried out by multidisciplinary teams and differ from conventional information-gathering approaches in that field workers work with and learn directly from local people. The methods involve a minimum of outsider interference or involvement (Pomeroy. and Rivera-Guieb, 2005). Several have been specially adapted for coastal and fisheries applications (Bay of Bengal Programme, 1993; Pido *et al*., 1996).

How is it used in EAF?
RRA can be especially useful in the early stages of scoping or introducing EAF when it is critical to quickly get information on the people in an area or industry. The RRA toolbox is broad, varied and constantly growing. The tool is chosen for a specific objective, context and conditions and should reflect "personal" tools of the user (Townsley, 1996). In a broad categorization, RRA tools include:

- secondary data reviews;
- workshops;
- structured observations;
- ranking and classifications;
- interviews;
- community meetings;

- mapping techniques;
- diagrams and graphics; and
- understanding processes and change.

Risk and vulnerability assessment

What is it?

Risk assessment is the term used to describe either a process or a product (of risk analysis), used in risk management. Risk assessment essentially determines whether the probability of a particular hazard, in relation to the severity of its impact, is considered acceptable or not when compared to some standard or benchmark. It is employed to guide decision-making. When the emphasis is on vulnerability as a special attribute of risk it is termed vulnerability assessment.

Why is it important?

Risk is a complex concept with a large perceptual component. It is important to systematically assess risk, usually quantitatively but also qualitatively, so as to remove some of the subjectivity found in the casual estimations of risk that people routinely make. Vulnerability, the flip-side of resilience, is important for noting the weakest links (those even more at risk) in a chain or system.

How is it used in EAF?

Decisions that utilize, or can benefit from, risk and vulnerability assessment occur at all levels of policy and planning in an EAF. These assessments, used at the policy level, can assist in selecting policies that have the least problematic impacts on the poor or women, for example.

Social mapping

What is it?

Social mapping is a visualization technique closely related to stakeholder analysis and cognitive mapping. It allows stakeholders to draw maps illustrating their interrelationships and their relationships to natural resources or other features of a particular location.

Why is it important?

The importance of social mapping, like many other visualization tools, lies in the ability to elicit information from stakeholders in a format that is easily understood and shared. This can serve as the basis for fruitful discussions and decision-making.

How is it used in EAF?

When different stakeholder groups (e.g. fishers and hoteliers), or people with different attributes within the same group (e.g. men and women) in an EAF each produce a social map their outputs can be compared in workshop sessions to determine and discuss reasons for similarities and differences. Since social maps reflect perceptions, attitudes, beliefs and values the information shared can assist the various parties to understand each other better and assist researchers or planners to take these differences into account in their work.

Stakeholder analysis

What is it?

Stakeholder analysis helps to systematically determine who needs to be a partner in the management arrangement, and whose interests are too remote to make this necessary. In doing this it also examines power, conflict, relative incentives and other relationships.

Why is it important?
The importance of stakeholder analysis lies mainly in its ability to ensure that the many actors in an EAF are properly identified and characterized in terms of their interests in the particular circumstance and some of their interactions that relate especially to power. Without stakeholder analysis being done at the start of the policy and planning cycles it is likely that critical actors will be omitted from the processes and that this will lead eventually to problems with the EAF. It is an important analytical tool that also helps to promote transparency.

How is it used in EAF?
There is no single best method of stakeholder analysis. Situation-specific common sense must be applied. Special care must be taken to ensure that voiceless and disadvantaged groups that may include women, youth, the elderly and poor people, are not excluded from the analysis. Multiple group memberships are common, especially in small communities. In such cases it will be necessary to be certain "who is speaking" at any given time (McConney *et al*., 2003). Stakeholder analysis poses questions such as:

- Who is directly affected by the problem situation being addressed?
- What are the interests of various groups in relation to the problem?
- How do groups perceive the management problem to affect them?
- What resources do groups bring to bear (for good or bad) on the problem?
- What organizational or institutional responsibilities do the groups have?
- Who should benefit, or be protected from, management interventions?
- What conflicts may groups have with each other and management strategies?
- What management activities may satisfy the interests of the various groups?

Survey methods

What is it?
Survey research is the collective term for a large variety of measurement methods in applied social research that involve asking questions of respondents, often combined with making observations (Converse and Presser, 1986). A survey method can range from a brief informal interview yielding purely qualitative data to an intensive in-depth questionnaire that is highly quantitative in content and analysis. There are methods for the scientifically rigorous treatment of both types of data. In addition, a survey can elicit information from the entire population of interest or may be based on samples, the costs of which will depend on the population of interest and other factors.

Why is it important?
Surveys present opportunities to elicit a great variety of data and information from respondents that provide insight useful for problem-solving and decision-making. Different groups of people can be compared and contrasted over a range of conceptually relevant variables often as part of hypothesis testing. Since managers involved in EAF will almost inevitable come across survey results, even from other sectors, it is important that they understand the benefits and limitations of surveys, when they should or should not be used, and how they can be abused.

How is it used in EAF?
In EAF, surveys are often part of larger methodologies, such as socio-economic monitoring and economic valuation. They can be part of any investigation in which the views of people or learning about their attributes are useful (Villareal *et al*., 2004). This can start with basic demographic and socio-economic data available from national population and housing census surveys that tell how many people reside in or use the area in which EAF will be introduced, and what their characteristics are. This

information can be used to design the policy and planning processes to ensure that all relevant aspects of the human dimension are addressed.

Transect diagram and walk

What is it?

A transect diagram is a cross-section illustration of an area such as on a line running from the nearshore to some distance inland. Bio-physical, infrastructure and socio-economic features are inserted to show the social-ecological characteristics of that section. A walk along the transect can be used to either construct or validate it, or both.

Why is it important?

It is a useful low cost method for gathering and sharing information in which all stakeholders can participate.

How is it used in EAF?

Transects of various parts of coastline can be used to enhance learning about ecosystems. If digital photographs or measurements are taken, the transects can be used in monitoring trends similar to ecological sampling stations. In this case the samples can be of human activity. The walks can be used for both information acquisition and dissemination while planning in a participatory manner.

Workshop methods

What is it?

Workshop method is the collective term for a suite of ways in which to get a group of people, normally with the assistance of a facilitator, to participate actively and effectively in tasks such as visioning, strategic planning, problem-solving, reaching consensus or other desirable end points.

Why is it important?

The event of "holding a workshop" should have associated with it a structured methodology to reach a pre-determined end point. Even brainstorming is structured to provide the latitude for creativity. It is not an unstructured process without rules. Hence it is important for fisheries manager to be familiar with various workshop methods and the extent to which they can meet the requirements of the EAF processes.

How is it used in EAF?

Workshops may occur in many parts of the EAF policy and planning cycles. For example, a visioning workshop may be held at the start of the policy and planning cycles to construct a shared perspective on what a variety of stakeholders see being put in place as a result of the implementation of EAF. Workshops are also an efficient way of sharing information with stakeholders as well as maintaining buy-in/interest throughout the EAF process.

This document aims to provide a better understanding of the role of the economic, institutional and sociocultural components within the ecosystem approach to fisheries (EAF) process and to examine some potential methods and approaches that may facilitate the adoption of EAF management. It explores both the human context for the ecosystem approach to fisheries and the human dimensions involved in implementing the EAF. For the former, the report provides background material that is essential to understand prior to embarking on EAF initiatives, including an understanding of key concepts and issues, of the valuation of aquatic ecosystems socially, culturally and economically, and of the many policy, legal, institutional, social and economic considerations relevant to the EAF. With respect to facilitating EAF implementation, the report deals with a series of specific aspects: (1) determining the boundaries, scale and scope of the EAF; (2) assessing the various benefits and costs involved, seen from social, economic, ecological and management perspectives; (3) utilizing appropriate decision-making tools in EAF; (4) creating and/or adopting internal incentives and institutional arrangements to promote, facilitate and fund the adoption of EAF management; and (5) finding suitable external (non-fisheries) approaches for financing EAF implementation.

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