TOWARDS ECOSYSTEM-BASED FISHERIES MANAGEMENT

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INTRODUCTION

1. After 50 years of particularly rapid geographical expansion and technological advancements, and a several fold increase in annual harvest, marine fisheries are at a crossroad. About half of the global marine resources are fully exploited while a quarter has some potential for increased catches while the remaining quarter is overexploited. While the conventional single stock resources management approach has shown its limitations, it cannot be considered the primary cause of past management failures. These can be attributed to a series of factors including the unwillingness to make politically difficult decisions on the allocation, the sharing and use of the resources, massive fleet over-capacities and insufficient scientific knowledge about interactions between species and between these and the environment in the ecosystem. There is, however, justified hope that the move towards an ecosystem-based fisheries management approach might be able to unlock some of the impediments that conventional management has experienced, not only the science of allocating fisheries resources but also the practical implementation. One reason is that this more holistic and integrative approach also calls for strong stakeholder participation, which brings squarely in focus human behaviour as the central management dimension.

2. But there are additional forces and issues that underlie the call for a transition to ecosystem-based fisheries management (EBFM). Those involved in fishing and dependent on it have recognized that resources must be managed sustainably with a long-term view. Society has developed much greater awareness about environmental impacts of unsustainable development and demands a change of course. Consumers from the main markets, mobilized by NGOs, are getting aware of the role they could play by expressing their preferences through their purchasing behaviour. A number of eco-labelling schemes are being proposed, tested or even implemented and they represent both an opportunity and a threat if equity cannot be ensured. The question of competition between top predators and Man is being asked from ethical as well as ecological point of views broadening the question of ecosystem resources utilization and ecosystem management objectives beyond the conventional limits. The request is for a broadening of the framework of all development activities, particularly fisheries, to encompass not only the marketed resource and some elements of its environment or accompanying species but the whole ecosystem.

3. The changes required in the transition to EBFM may entail considerable sacrifices and costs to the fisheries sector, particularly in the short-run. However, these are likely to be compensated in the medium-term and it can be taken for certain that all interested parties are going to gain large benefits in the long-term. The time span for these evolutions will vary greatly depending on the current state of the fishery resources and of the ecosystem they are part of, and they will therefore have to be assessed from case to case. It will be important to ensure that costs are not solely shouldered by the fishery sector, but that these costs are equitably born by all those participating in the use of the ecosystem and therefore beneficiaries of the additional welfare, which will be created. Again this will vary greatly between regions and situations depending on the relative importance of the fishery sector and of other uses of coastal and marine areas. The need to assess the role

and responsibility of other sectors should of course not detract from the urgent need for fisheries to correct the problems attributable to ineffective fisheries management practices.

4. The Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem, jointly organized by FAO and Iceland, with the co-sponsorship of Norway, represents an important opportunity for all the fishery stakeholders to, jointly, address the basic principles of the transition to ecosystem-based fisheries management and express each others expectations and concerns. It is also an opportunity to delineate the way towards effective fisheries management, suggesting options available to face the present challenge and expressing commitments to work towards the fisheries of the new millennium.

ORIGIN AND ORGANIZATION OF THE CONFERENCE

5. The idea of hosting the Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem emerged during meetings of the Director-General of FAO and high-level representatives of the Government of Iceland. The proposal was endorsed by the 24th Session of the FAO Committee on Fisheries (26 Feb - 2 Mar 2001) and at the 120th Session of the FAO Council (June 2001). The Conference is to provide an in-depth analysis on important global issues relating to fisheries and the implementation of the Code of Conduct for Responsible Fisheries. The central theme of the Conference is intended to reflect on the implications of the global trends towards ecosystem-based management for capture fisheries.

6. The objectives of the Conference are:

   - to gather and review the best available knowledge on marine ecosystem issues
   - to identify means by which ecosystem considerations can be included in fisheries management, and
   - to identify future challenges and relevant strategies.

7. The Conference will comprise two Plenary Sessions with the participation of policy-makers and administrators in fisheries and ocean management within national and international institutions. It is expected that participants will include also scientists, representatives of the industry, NGOs and other interested parties. In order to promote dialogue between these groups a Scientific Symposium has been organized together with the Conference in which overview papers will be presented by invited experts and followed by extensive exchanges of views on the issue being discussed.

8. In order to "set the stage" and allow a common understanding, the participants will be offered over-views of the state of the marine capture fisheries and their ecosystems, of the implications of existing international conventions and other legal instruments to EBFM, as well as views from the large-scale and small-scale fishing industrial and environmental perspectives.

9. During the Scientific Symposium (including poster sessions) the participants will address some of the scientific issues, which are central to EBFM. This will be done under three broad headings:

   (a) the dynamics of the ocean ecosystems, encompassing the complexity and natural variability of the exploited ecosystem which give rise to much of the uncertainty surrounding fisheries management;
   (b) the role of man in the ecosystem addressing multiple uses of the ecosystem illustrating the sources and extent of human impacts on marine ecosystems; and

(c) the implications for fisheries governance, analyzing the challenges of incorporating ecosystem considerations in integrated ocean management.

10. Time has been allocated for discussion which, hopefully, will focus on practical ways and means of implementing EBFM so as to achieve better conservation of the living resources and long-term benefits for human-kind. The ideas discussed and raised are expected to be formulated into a Conference Declaration on feasible and practical implementation of EBFM to be submitted to the 31st Session of the FAO Conference (November 2001) and to the World Summit on Sustainable Development (UNCED+10) in Johannesburg, 2-11 September 2002.

THE STATE OF WORLD FISHERIES

11. Production: Reported global production of marine capture fisheries has increased from 17 million tonnes in 1950 to about 80 million tonnes in the mid-1980s, oscillating since then between 78 and 86 million tonnes (excluding discards), representing 67-84% of the overall fisheries production, including aquaculture. The annual rate of increase of marine catches decreased to almost zero in the 1990s, indicating that, on average, the world oceans have reached their maximal production under the present fishing regime. However, this situation hides important changes in the species composition of world fish catches: the proportion of low value species has increased substantially since the 1970s while the proportion of the traditional target resources, as well as average sizes, have gone down. These realities indicate that current production may not be sustainable under present circumstances.

12. Resources: The data available for 1999 for the 16 FAO statistical regions of the world's oceans indicate that four of them (25%) are at their maximum historical level of production, eight (50%) are slightly below it and four (25%) are well below it. In most areas, overfishing is certainly a significant factor responsible for the declines. The same data show that, among the close to 600 “stocks” or groups of resources for which FAO has obtained information, about a quarter of the resources could perhaps produce more, more than a quarter are overexploited and need rebuilding and a little less than half are exploited close to their maximum level of productivity. These global figures reflect evident shortcomings in the management of many fisheries resources to maintain them at their highest productive level. Altogether, the information available tends to confirm the estimates made by FAO in the early seventies that the global potential for marine fisheries is about 100 million tonnes of which only 80 million tonnes were probably achievable for practical reasons. It also confirms that despite local differences, overall, this limit has been reached.

13. Fishing fleet: There are no totally reliable or comprehensive data on global fishing power or even of fleet size, and data for small-scale fisheries are scanty. The FAO analysis based on the Lloyds Register and its own databases indicates that the global fishing fleet increased rapidly between the 1950s and the 1990s through the fleets extending their operating range (from 1950 to 1970) and adoption of new technologies. During the last decade, the fishing power of individual vessels has continued to grow through a range of technological advances not the least ever more advanced and more economic electronic fish finders. Yet these advances in technology should not be viewed in a negative light, rather that they make more demands for effective fisheries management. During the last few years, the number of fishing vessels has tended to decrease in developed countries and to increase in some developing ones.

14. Fishers: Employment in the primary capture fisheries and aquaculture production sectors in 1998 is estimated to have been about 36 million people, comprising about 15 million full-time, 13 million part-time and 8 million occasional workers of which it is

estimated that about 60% are employed in marine fisheries. For the first time since the early 1970s, there is an indication that growth in employment in the primary sectors of fisheries and aquaculture may be slowing down significantly.

15. Technology: The effectiveness of fishing gears for catching fish has evolved rapidly since the early 50's. Yet, fishing gear has become more environmentally friendly, e.g. by becoming more selective. Safety on-board fishing vessels has also improved, although fishing remains one of the most dangerous kind of employment with more than 25 000 fatalities per year (SOFIA 2000). Advances in technology have also made fish processing and fish preservation more effective than ever – making high quality products more prominent than ever on the international markets. It could be argued that advances in technology, not the least in telecommunications, could make implementation of EBFM more likely to materialize.

16. Fish trade: Fish has become the most internationally traded food, as some 37% (by quantity) of all fish for human consumption is traded across borders. Developing countries now provide some 50% of the fish in international trade, and their net foreign currency income from fish exports rose to some US$ 16 million in 1999. Improvements in logistics, not the least in air freight, is making it practically possible to bring fish from the most remote corners of the world to the international market. Coupled with rising demand and higher prices than ever, the market pull exerts pressure on the resources unless effective fisheries management is enforced. International trade rules can be conducive to sustainable fisheries or they can undermine the resource management. The recent international trade negotiations have shown that there is a strong link between trade and sustainable resource use as manifested in the various environmentally linked issues entering the trade negotiations such as subsidies and overcapacity.

17. Contribution to food security. The oceans' ecosystems contribute substantially to human food security through direct use as human food and through reduction to meal and oil for animal feed. The reported production for direct human consumption practically doubled between 1950 and 1970, and has tended to stabilize since then at an average of 9.0 to 10 kg of fish per capita and year, notwithstanding world population growth. However, the proportion of production used directly for human food has declined from about 80% in the 1950s to about 65% since the early 1970s due to the rapid expansion of reduction fisheries particularly in South America. As total marine capture production is probably close to its maximum while world population growth continues, the per capita supply from marine capture fisheries is likely to decrease, unless more effective management of capture fisheries and further development of aquaculture can increase production.

18. Food safety: While fish has become recognized as a particularly healthy food, there are concerns for fish quality. Contamination from harmful algal blooms (generated by eutrophication and pollution), as well as pathogens (from untreated sewage), oil spills, heavy metals, PCBs, and dioxin is becoming more widely known.

FISHERIES AND THE ECOSYSTEM

19. Ecosystem characteristics: The marine ecosystem is highly productive and successfully used by humans as a source of recreation, food, pharmaceuticals and livelihood in general. These uses impact on the ecosystem and forecasting and controlling the fisheries impacts is one of the key tasks of science-based fisheries management. This task is greatly complicated by uncertainties arising from difficulties in observing and measuring ecosystem components and properties and by the enormous natural variability, at a range of time-scales, in inter alia the distribution, age and species composition, and abundance of fisheries resources. On a longer time-scale, the

ecosystem is affected by global climate change which will probably affect many aspects of fish distribution and dynamics. The marine ecosystem is also significantly impacted by pollution and other degradations, which are usually beyond the control of fishery authorities. Responsible fisheries management requires recognizing these various impacts and adjusting to them, taking remedial steps where necessary if the production of ecosystems is to be maintained.

20. State of the ecosystem: Little attention has been focused in the past on evaluating the status of marine ecosystems as a whole and there is little information on this. In general, marine ecosystems are less perturbed and damaged than inland and terrestrial ecosystems. However, human impacts are still very noticeable, particularly in the coastal areas, and impacts have been noted nearly everywhere, from the Arctic to the Antarctic oceans and extending to the open ocean. Pollution is important, reaching the oceans through rivers, aquifers, sewage (point sources), drainage (non-point sources) and the atmosphere (wind and rain). GESAMP, the IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection, has produced a global assessment (GESAMP, 2001) indicating that, aside from overfishing, the ecosystem is affected by:

    - alteration and destruction of coastal habitats and ecosystems: coral reefs, mangroves, wetlands;
    - industrial pollution e.g. persistent pollutants (POPs), heavy metals, hormone-disrupting substances;
    - sewage pollution leading to contamination of seafood (e.g. cholera, typhoid);
    - pollution by nutrients notably fertilizers leading to widespread and increased eutrophication, contributing to destruction of seagrass beds and toxin-producing algal blooms;
    - changes (increase or decrease) in sediment flows due to deforestation, bad cultural practices, public works, etc.;
    - global warming (see above); and
    - the direct impact of fishing on the environment.

21. Impacts on fisheries: The impacts of land-based and coastal alterations on the marine ecosystem affect the livelihoods of coastal fishing communities and industries and the food security of the poorest ones. They lead to loss of economic opportunities and compound the effects of unsustainable fishery development strategies. Those of direct relevance to fisheries include the following:

    - Reduction of the maximum sustainable yield expected from a resource, resulting from the alteration, obliteration or destruction of habitats critical to various stages in the life histories of fishes.
    - Modification of the resource species composition, health and diversity. Alterations in the environment lead to genetic selection of the most resilient species, which are commonly those of lower market value and some pollutants modify essential biological processes. Introduction of alien invasive species through ballast waters of trans-oceanic vessels is becoming a serious problem in many areas.
    - Increase in ecosystem instability and variability.
    - Reduction of seafood quality and safety as discussed above.

22. Impacts of fisheries on ecosystems are sometimes difficult to separate from environmental effects but have nevertheless been repeatedly stressed. They are widespread and include direct impacts of overfishing, modifying community species composition and genetic diversity through selective targeting on species and particular size classes; impacts on non-target species through low selectivity of certain gears;

incidental mortality from lost or abandoned gear, direct impact on the sea bed through e.g. trawls and dredges; and destructive illegal "fishing gear" such as dynamite and poisoning. Discarding of about 20 million tonnes of unwanted fish represents wastage of potentially valuable resources. Progress has been made in addressing some of these, for example through development of more selective gear and more effective zoning practices including the use of marine protected areas. However, the net effect is still frequently inadequate, and frustrated by problems such as open access and excess fishing capacity.

23. Value of the ecosystem: The real total value of ecosystems and the relative contribution of the different sectors using it are usually not appreciated but there are some estimates which would indicate that the global value of the goods and services provided by marine and coastal ecosystems is roughly double the value of goods and services provided by terrestrial ecosystems and comparable to the level of Global GDP. In recognition of their enormous contribution, there is a growing pressure from society for giving the maintenance of the ecosystem an adequate weight in the decision-making process. Failing to do so puts at stake the human welfare derived from these systems.

STATE OF GOVERNANCE

24. There is no complete global inventory of fisheries management systems and approaches, by countries, stocks or fisheries. At national level, while most countries have in place some form of licensing scheme, they often experience great difficulties in effectively containing an expansion of harvesting capacities. In several countries, access to marine fisheries resources continues to remain unrestricted. However, an increasing number of countries are effectively managing their fisheries and make available the necessary inputs to do so. More recently, there is an increasing interest in rights-based fisheries management including individual, company or community held quotas (IQs), both transferable or non-transferable. Several of the over thirty regional fishery bodies (RFOs) implement policies based on Total Allowable Catch (TAC) and national quotas. At all levels, these approaches are complemented by a series of technical measures to regulate vessels (e.g. power, size); gear (e.g. size, mesh size); area fished (e.g. closed areas) and fishing time (e.g. fishing effort ceilings, closed seasons); or catch characteristics (e.g. minimum landing size, stage of maturity, egg-bearing), etc. A serious constraint in some regions is the inadequate enforcement of and compliance with management measures at both national and regional levels.

25. Fishery management performance is definitely improving for many fisheries but in far too many cases it is inadequate or even poor. A principal weakness of current management is its widespread reliance on blocking the growth in fishing capacity and effort rather than altering the incentive structure through a rights-based approach that encourages fishers to minimize harvesting capacities and costs and confers stewardship in the protection and conservation of fishery resources and fish habitats. The many deficiencies often invoked to explain the poor state of many marine fishery resources, such as excess fishing capacity and effort, insufficient selectivity, poor policing and compliance, etc. are largely the direct or indirect consequences of inadequate limited access regimes. Introducing rights-based management, however, raises the thorny issues of resource allocation with the selection of the fishing right holders and deciding on the characteristics of the rights (exclusivity; security; permanence and transferability). These necessary decisions, with significant long-term benefits for the State, the right-holders and the consumer, can have short-term economic and socio-political costs which many politicians find hard to face. The shift to EBFM may not resolve these problems but heighten the urgency for addressing them.

26. The fisheries management context and framework have greatly improved through a range of initiatives at global, regional and national levels. Overfishing and excess fleet capacities have been generally recognized as worldwide problems (e.g. at UNCED and FAO) calling for socially acceptable and effective solutions. With the coming into force of the 1982 Convention, the fisheries policy framework has become stronger and was re-enforced by the adoption in 1995 of the Code of Conduct for Responsible Fisheries. It will soon be further strengthened by the coming into force of the 1993 FAO Compliance Agreement and the 1995 UN Fish Stocks Agreement. The Code has been complemented with a series of technical guidelines including on fisheries management, on indicators for sustainable development of marine capture fisheries, and on the precautionary approach to capture fisheries and species introductions. Its implementation will also be strengthened by the four International Plans of Action (IPOAs) recently adopted by FAO members: (a) IPOA for the Management of Fishing Capacity; (b) IPOA for the Conservation and Management of Sharks; (c) IPOA for Reducing Incidental Catch of Seabirds in Longline Fisheries; and (d) IPOA to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing. The inherent existence of uncertainty and risk is formally recognized in all modern fisheries agreements as reflected by the implementation of the precautionary approach and the societal quest for more transparency. The broader biodiversity and habitat considerations are being faced and the need to protect the ecosystem is broadly accepted as a fundamental need.

IMPLEMENTING EBFM

27. During the last century, fisheries management has always had as its foundations the need to maintain stocks at their highest level of productivity and the principle of rebuilding accidentally depleted stocks. It has also always considered the ecosystem, even if indirectly and generally ineffectively. The United Nations Law of the Sea requires States to ensure that harvested species and species associated with or dependent on harvested species are not over-exploited either in national EEZs (Article 61) or in the high seas (Article 119). The emphasis on ecosystems has been strengthened since the 1992 UNCED Summit. In addition to those international instruments relating to fisheries specifically (see paragraph 26) many others initiatives have been taken calling for more responsible “management of the ecosystem”. These include, for example:

    - the Global Plan of Action for the Protection of the Marine Environment (GPA), adopted in 1995 to address the fact that 80% of the marine pollution is caused by human activities on land;
    - the Convention on Biological Diversity (CBD) which came into force in 1993, including the Jakarta Mandate on Marine and Coastal Bio-diversity (CBD-JM), adopted in 1995, which provides a new global consensus on the importance of marine and coastal biological diversity;
    - the FAO Commission on Genetic Resources for Food and Agriculture which has broadened its mandate to cover aquatic resources;
    - the International Coral Reef Initiative (ICRI), dedicated to reef conservation and management since 1994; and
    - the Marine Protected Areas initiative launched by the Global Environment Facility (GEF) and the World Bank, in collaboration with the World Conservation Union's (IUCN), the Commission on National Parks and Protected Areas (CNPPA) and the Great Barrier Reef Marine Park Authority (GBRMPA).

28. Implicit in all initiatives for management of the ecosystem is recognition that man cannot manage the ecosystem as such, but only the human activities using it. It follows that fisheries authorities on their own do not have the full mandate nor authority for ecosystem management and that a pre-requisite for effective ecosystem management is coordination between all sectors using or impacting on marine ecosystems. Nevertheless,

much can be achieved by fisheries management agencies in achieving ecosystem-based management of fisheries.

29. The implications of implementing EBFM are, in fact, not new, and have already been mentioned in the FAO Code of Conduct for Responsible Fisheries which includes the conservation of the aquatic ecosystems in its General Principles (Art. 6.1)[1/] The Code also refers to the "protection of living aquatic resources and their environments and coastal areas" (Art. 2) and to "respect biological diversity" (Code Introduction). Therefore, this Conference is not discussing a new concept, rather it is revisiting and re-emphasizing principles and needs that have long been recognized but not yet sufficiently acted upon.

30. A first step in moving towards EBFM is to identify and describe the different ecosystems and their boundaries, and then to consider each as a discrete entity for the purposes of management. Thereafter. ecosystem management objectives must be developed. The central objective of EBFM is to obtain optimal benefits from all marine ecosystems in a sustainable manner. This requires the maintenance (or rebuilding) of the ecosystem, its habitats, and biodiversity to a status capable of supporting all species at levels of maximum production. In pursuing this central objective, many if not most of the main conventional fishery management objectives and constraints remain inescapable even though subject to ecosystem constraints: e.g. improvements in fishing technology (which should not be stopped); maximal production (to match growing demand for food); maximum employment (particularly in highly populated and poor areas, along coastal deserts, etc.); minimization of conflict (within fisheries but also among different sectors). Equitable allocation of resources through systems of rights remains a central challenge.

31. There are many other objectives referred to in the Code, including: protection and restoration of critical habitats such as wetlands, mangroves, reefs, lagoons, nursery and spawning areas from degradation, destruction, pollution, etc. from human activities (Art. 6.8; 7.6.10); maintenance of the quality, diversity, and availability of resources (Art. 6.2); restoration/rehabilitation of populations and stocks (6.3;7.2.1); conservation of biodiversity and population structure (Art. 6.6; 7.2.2); protection of endangered species (Art. 7.2.2); and others. Important other objectives such as maintaining rural livelihoods or contributing to the foreign exchange balance will also continue to be considered.

32. In order to realize these objectives, all potential conflicts and inconsistencies need to be reconciled to arrive at a set of simultaneously attainable objectives encompassing biological, ecological, economic, social and institutional concerns. As in conventional single-species management, the objectives must be formulated and reconciled in full consultation with all legitimate interested parties to ensure that their collaboration is obtained in achieving responsible fisheries (Art 7.1.2).

33. Once the objectives have been identified and agreed upon it is necessary to establish appropriate reference points (Art 7.5.3) and/or sustainability indicators, reflecting the objectives and elements of particular interest in the ecosystem, to assist in monitoring the state of the ecosystem and the performance of management efforts. These sustainability indicators must be based on the best scientific evidence available. An appropriate monitoring system is required to ensure that the information necessary for tracking the state of the ecosystem is available when required, in order to assess regularly the state of the ecosystem and the impacts on it (Art. 8.4.7; 10.2.4; 12.11).

34. Achieving the objectives in EFBM requires suitable management measures. Again the general principles used in conventional single species management will still apply, but

1/ "States and users of living aquatic resources should conserve aquatic ecosystems".

will need to be extended. Overall, in setting management measures, attention must be given to (Art 7.2.2 a- g):

- avoiding excess fishing capacity;
- ensuring economic conditions which promote responsible fisheries;
- taking into account the interests of fishers, including those at sub-industrial levels;
- conserving bio-diversity, protecting endangered species and restoring depleted species;
- assessing adverse environmental impacts on the resources and addressing them;
- minimizing pollution, waste, discards, catch by lost or abandoned gear, catch of non-target species and impacts on associated or dependent species.

35. More specifically, the Code provides for an assessment of impacts on target stocks, associated or dependent species (Art. 7.2.3; 12) including before introducing any new fishing method or operation in an area (Art. 8.4.7; 12.11); reduction and minimization of environmental impact (pollution, discards, ghost fishing) on target and associated, dependent, or endangered species (Art. 7.2.2; 7.6.9); and prohibition of destructive fishing (Art. 8.4.2); improvement of selectivity (Art. 8.5.3; 12.10); reduction of impacts on target and non-target stocks (Art. 6.2; 12.10); prevention of over-fishing and over-capacity (Art. 6.3) so as to ensure that the level of fishing is commensurate with the state of fisheries resources (Art. 7.6.1); assessing impact of climate change (Art. 12.5) and other ecosystem-oriented considerations. Given the high levels of uncertainty concerning the status and dynamics of ecosystems and their elements, and their response to perturbation, emphasis on application of the precautionary approach is central to EBFM (Art. 7.5.1).

36. The problems associated with open access systems have been previously discussed and, in order to avoid these, the allocation of various forms of explicit legally enforceable fishing rights is integral to EBFM. In allocating rights, it is necessary to consider all aspects of the ecosystem, such as by-catch and affected species and impacts of gear on the environment. Further, the right to fish must carry with it the obligation to fish in a responsible manner, so as to ensure ecosystem conservation (Art. 6.1).

37. As was the case in setting objectives, it is necessary to establish an effective consultation and decision-making process in order to consult regularly with all legitimate stakeholders on appropriate management strategies and other matters requiring attention. Broadening the scope of management to include the ecosystem will also usually mean increasing the number and range of interest groups. This will invoke greater time and costs for consultation and decision-making but is essential for ensuring compliance and co-operation. The same mechanisms and processes should be used to review the management system and measures regularly and to adapt them as necessary to respond to changes in the ecosystem or the objectives of the stakeholders.

38. Effective consultation is essential for compliance but in even the best systems, it will be necessary to establish effective enforcement systems as required (Arts 7.7.2; 8.1.1).

39. The above requirements imply that EBFM can and should be implemented now and with existing knowledge. Nevertheless, uncertainties in our knowledge and ability to forecast will detract substantially from the ability to achieve optimal management. In an effort to reduce these uncertainties it is important to promote relevant research on such subjects as:

- improving knowledge of the food webs, including prey and predators relationships, to facilitate consideration of possible ecosystem responses to different management actions;

- ensuring all critical habitats for the key species in the ecosystem are located and mapped and identifying and addressing any threats to these;
- improving the monitoring of by-catch and discards in all fisheries to obtain a better knowledge of the amount of fish actually taken;
- considering improved methods for consultation and joint-decision making so as to improve ecosystem governance;
- studying any threats to the marine ecosystems from human sources outside fisheries, whether land-based or marine, and investigating means to minimize these.

CONCLUDING REMARKS

40. In the global forum debate for conservation of ecosystems, the demand for improved fisheries management is very high, fuelled by local fisheries crises, constant media attention, growing concern by industry, and active role of the NGOs concerned with fisheries and environmental matters. Faced with a series of international instruments adopted at the highest level, and with direct implications on fisheries, governments and their fisheries authorities are expected to foster a significant change.

41. Given the fact that fishery management systems, based initially on single-species approaches and then increasingly including multi-species considerations, have failed in many situations, the question must arise whether the addition of yet another dimension, namely the ecosystems, offers better chances for achieving long-term sustainability of fishery resources. The answer will certainly include the essential point that first and foremost present fishery management schemes must be improved to contribute achieving this objective. EBFM cannot replace traditional schemes, it can only add to them and this added dimension has indeed potential to reinforce current approaches, because it will reduce the uncertainties inherent in current management decision-making. Ecosystems factors not adequately taken into account in present fishery management decisions have all too often been the source of unpleasant surprises for fishery scientists and fishery policy makers alike, and of course for the fisherman.

42. It should be well understood that the broadening of the fisheries management approach does not call for any revolution. Adding ecosystems considerations to present methods can be done gradually. However, some evident changes are called for, the most important being:

    - Instead of addressing a definite fish stock solely, the whole ecosystem and its components will have to be included in the considerations; this may well start with some factors only also depending upon the availability of data.
    - Definition of management objectives will be broader, without loosing sight of those of particular short-term interest to the fisheries sector.
    - The number of reference points and indicators will increase, and thus the need to widen the scientific base for management decisions.
    - The monitoring, control and surveillance systems will have to be strengthened with inevitably higher costs.
    - The institutional arrangements will have to be strengthened and broadened to include non-fishery stakeholders and allow consultations with all legitimate interested parties on management objectives as well as management measures, although those from the fishery sector, including the fishermen themselves, will continue to be the nucleus.
    - Stakeholder engagement should be promoted through training and public awareness programmes.

- A considerable extra effort in research will be required; not only targeted at verifying indicators and reference points, but also on the economic and social implications of EBFM, including e.g. the equitable sharing of costs and benefits between stakeholders.
- A visible leap ahead in assisting developing countries should be made to increase their capacity to introduce this wider fishery management concept into their fisheries.

43. Although it is the responsibility of States to efficiently manage its marine fishery resources, it is in the interest of all stakeholders to reduce the uncertainties associated with current fishery management systems. Among the main medium-and long-term beneficiaries will be the industry itself and the fishermen. It will therefore be in their interest to meet the challenge and take a more prominent role in the promotion and design of EBFM approaches. A successful EBFM must be founded on their will to meet these challenges.

44. Taking in to account the knowledge of the subject, summarized during the Scientific Symposium, the Conference is requested to review and provide guidance on ways and policies required to complement ecosystem based management of marine fisheries.