

THE MARINE ENVIRONMENT AND FISHERIES

Global Initiatives Related to UNCED

by

Heiner Naeve¹

ABSTRACT

One of the objectives of the APFIC Symposium on Environmental Aspects of Responsible Fishing was to strengthen awareness raising on the various environmental changes that have or may have impacts on aquatic living resources and fishing, and on global efforts to deal with such issues.

This paper briefly summarizes the impacts of man-made changes in the marine environment on aquatic resources and fisheries, as well as the environmental impacts caused by fishing and aquaculture. It then describes some early global initiatives that paved the way to the 1992 Rio Conference on Environment and Development, highlighting the outcome of that conference relevant to oceans, the marine environment and fisheries, Chapter 17 of Agenda 21, and concentrating on global action that ensued from the conference. Particular emphasis is given to three initiatives: the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, the Code of Conduct for Responsible Fisheries, and the Global Ocean Observing System.

1. ENVIRONMENTAL DEGRADATION AND CHANGE

1.1 Climate changes

The amplitude and pace of anticipated global climate changes are still not clear, and it is therefore difficult to forecast their effects on fisheries and aquaculture. Large changes in total marine fish production are not expected although particular stocks will be affected. Changes in rainfall patterns and river runoff, as well as sea-level rise, will affect life in coastal wetlands, estuaries, lagoons, mangroves and other important coastal nursery areas. Rainfall-induced soil erosion may increase, leading to coastal siltation, reduction of the marine photic zone and further degradation of coral reefs and sea-grass beds. Coastal aquaculture practices in locations exposed to such changes are also likely to be affected.

1.2 Environmental effects on fisheries

Coastal ecosystems, such as estuaries, marshes, shallow bays and wetlands, mangroves, coral reefs and sea-grass beds, play a major role in the life cycle of many economically important fish species by providing breeding, nursery and feeding grounds. About 95 % of world marine production originates from coastal ecosystems. Marine fisheries are threatened by the accelerated degradation of ecosystems, land reclamation, drainage, coastal construction, sewage and waste water discharges, and many other competing uses.

¹ Fishery Resources Division, Food and Agriculture Organization of the United Nations, Rome, Italy.

According to the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), at the end of the 1980s, the major global causes of immediate concern to the marine environment are coastal development and the attendant destruction of habitats, eutrophication, microbial contamination of seafood and beaches, fouling of the seas by plastic litter, progressive build-up of chlorinated hydrocarbons, especially in the tropics and the subtropics, and accumulation of tar on the beaches. However, concerns may differ from region to region, reflecting local situations and priorities. Furthermore, throughout the world, public perception may still accord greater importance to other contaminants such as radionuclides, trace elements and oil, regarded by GESAMP as being of lesser concern (GESAMP, 1990).

Specific regional studies covering the Asia-Pacific region were prepared by Sen Gupta *et al.* (1990) and Gomez *et al.* (1990). They identified a major source of organic pollution as the discharge of untreated or only partly-treated sewage into coastal waters, resulting in eutrophication and elevated coliform counts. Red tides occur regularly; however, their link to eutrophication or sewage discharge is still not certain. Since important tanker lanes pass through the region, there is also the constant risk of oil pollution.

More and more concern has been expressed at the destruction of productive ecosystems like mangrove swamps and coral reefs. In the Maldives, for instance, the extraction of coral and coral sand for preparing lime and cement for construction purposes has reached a critical level (Sen Gupta *et al.*, 1990).

In South East Asia, mining is a major industry, contributing to sediment deposition through the discharge of tailings and resulting *inter alia* in water turbidity and damage to coral reefs. Copper mining in the Philippines and tin extraction from the sandy seabed of the Andaman Sea also serve as examples (Gomez *et al.*, 1990).

While, possibly apart from some enclosed seas, no areas of the ocean and none of its principal resources appear to be irrevocably damaged, and most are still unpolluted, while there are encouraging signs that in some areas marine contamination is decreasing, GESAMP was concerned that too little is being done to correct or forecast situations that require action, that not enough consideration is being given to the consequences on oceans of coastal development, and that land-based activities continue with little regard to their effects in coastal waters. Particularly in view of the constant growth in human population, GESAMP feared that the marine environment could deteriorate significantly in the next decade unless strong, co-ordinated national and international action was taken (GESAMP, 1990).

1.3 Impacts of fishing on the environment

In recent years, environmental perspectives of fisheries have been attracting more and more attention (Caddy and Griffiths, 1995). GESAMP did single out "Effects of Fishing" as one of the matters of particular concern regarding the degradation of the marine environment (GESAMP, 1996a). A new book on the issue is currently in press (Hall, 1997).

Whilst much attention is being given to overexploitation of living marine resources, GESAMP is concerned that environmental effects of fishing are neglected. For example, in the North Sea, one of the most heavily exploited fishing areas, it is suggested that the whole seabed below 10 metres depth is trawled over twice a year and many areas up to six times. The gear used is getting heavier over time and with modern technological aids there are no longer trawl-free refuges. The sediment and its living communities are severely disrupted by these activities, and communities may be significantly altered, resulting in destruction of echinoderms, sponges and bivalves. Biogeochemical cycling of elements and organic material is also altered.

In addition to intensive dredging or trawling, tropical habitats suffer from illegal techniques such as the use of dynamite or chemicals to capture reef fish. Such abusive practises are used in many parts of Asia, e.g., Indonesia, Malaysia, Philippines, Thailand. Marine aquarium fish used to be collected in large quantities by the use of sodium cyanide, a practice now discouraged by importers (Gomez *et al.*, 1990). Sodium cyanide is still commonly used in the region to catch high valued food fish for marketing live in places like Hong Kong and Singapore.

In recent years, concern has been directed particularly toward involuntary and incidental capture or entanglement of marine mammals, birds and turtles by operative as well as lost/discarded fishing gear. Improved gear design and fishing practices could minimize incidental capture.

Other consequences of overexploitation and fishing for selected species are alterations of ecosystem feeding relationships: for example, overexploitation of a large migrating herring stock can result in a large increase in the food for herring, copepods, with consequences for bottom-living fish such as capelin. In the Gulf of Thailand, economically valuable predator species have largely been replaced by small trash fish.

Selected exploitation of one species means that large quantities of by-catch are returned to the sea, which has in turn led to dramatic changes in the structure and functioning of the benthic system, and the system as whole.

The limited evidence available suggested that these problems are global and of such a scale that in some localities they may outweigh environmental effects of contaminant discharges in terms of their ecological significance. As a matter of high priority, GESAMP (1996a) urged that relevant international and national organizations initiate wide-ranging studies on the effects of commercial fishing on the marine environment.

A practical method of assessing the effects of fishing intensity on benthic communities is the creation of exclusion zones. However, due to lack of funding and conflicts of interests between the fishing community and administrations, few, if any, such experiments have been carried out. GESAMP considers it a high priority to create exclusion zones as control areas for assessing the effects of commercial fishing and urges governments to take appropriate action.

Artificial reefs constitute trawl-free zones and at the same time act as fish aggregation devices for enhancement of artisanal fisheries. The Asia-Pacific region in particular has accumulated vast experience in this method.

1.4 Impacts of aquaculture

Rapid aquaculture expansion in some coastal regions has caused ecological impacts such as nutrient and organic enrichment in water and sediments, and changes in the biodiversity of coastal ecosystems, which in turn have had important socio-economic consequences. In general, ecological impacts stem from a lack of adequate coastal planning, management and consideration of the environmental compatibility of farming methods applied in relation to particular sites. Often, mitigating measures have not been considered or have proven to be ineffective or prohibitively expensive. In some cases, ecological change is irreversible or recovery from an impact slow.

The type and scale of any ecological change associated with coastal aquaculture development will depend on the method of aquaculture, the level of production and the physical, chemical, and biological characteristics of a given coastal area. The conversion of wetlands, in particular mangrove forest areas, for construction of shrimp culture ponds has become a highly controversial ecological and economic issue. Ecological change has also been associated with the large-scale production of bivalves and seaweeds and the release of dissolved and particulate waste from fish, shrimp, and bivalve culture. Some ecological changes, such as the impact of organic waste on the seabed ecosystem, can limit production.

The introduction and transfer of species and breeds for aquaculture purposes may alter or impoverish the biodiversity and genetic resources of the marine ecosystem through interbreeding, predation, competition, habitat destruction and, possibly, through the transmission of parasites and diseases (Barg and Wijkström, 1994).

The indiscriminate use of bioactive compounds, including pesticides and antibiotics, has caused concern about their release into the aquatic environment. The health implications of the use of chemicals and the consumption of seafood grown in contaminated waters are also problems of growing concern, especially in relation to generation of drug resistant pathogens, to intoxication by phycotoxins, and to infectious diseases such as typhoid fever, cholera, and hepatitis.

Sustainable coastal aquaculture necessitates appropriate forethought of the interactions between the social, economic and ecological changes. This can be achieved through an integrated approach to planning and management of coastal aquaculture, possibly within the framework of integrated coastal zone management.

The need for greater environmental awareness and management in support of sustainable coastal aquaculture development has been addressed by numerous authors and institutions, e.g., Chua *et al.* (1989), Barg (1992), GESAMP (1991), Chua (1993), FAO/NACA (1995), Bagarinao and Flores (1995), Phillips (1995).

2. EARLY INITIATIVES OF THE UNITED NATIONS SYSTEM

For more than 25 years, the United Nations system has addressed subjects related to the protection and management of the marine environment.

In 1969, IMO, UNESCO, FAO and WMO founded the **Joint Group of Experts on Scientific Aspects of Marine Environmental Protection (GESAMP)**, later joined by WHO, IAEA, United Nations and UNEP. Since 1993, the functions of GESAMP are to provide advice relating to the scientific aspects of marine environmental protection to the sponsoring agencies, to other UN organizations and to Member States of the United Nations organizations, and to prepare periodic reviews and assessments of the state of the marine environment and to identify problems and areas requiring special attention (Windom, 1991). Recent reports on direct relevance to fisheries dealt with environmental impacts of coastal aquaculture (GESAMP, 1991; 1996), and integrated coastal management (GESAMP, 1996b). The last report on the state of the marine environment was published in 1990 (GESAMP, 1990).

GIPME, the Global Investigation of Pollution in the Marine Environment, originally created in 1971 as a joint initiative of the three advisory bodies of IOC, ACMRR, SCOR and ACOMR, and GESAMP, later became the IOC/UNEP/IMO Committee for GIPME. In the Comprehensive Plan for GIPME (IOC, 1976), priority was given to the monitoring of pollution in coastal waters, starting with baseline studies on a national or regional scheme. The Committee now has Groups of Experts on Methods, Standards and Intercalibration (GEMSI), on Effects of Pollution (GEEP) and on Standards and Reference Materials (GESREM). While studies on marine pollution *per se* are of course of relevance to fisheries, GEEP, in particular, deals with biological and ecological effects of pollution.

The Regional Seas Programme of the United Nations Environment Programme was launched in 1974 as a global programme implemented through regional components. The substantive aspects of each regional programme is outlined in an Action Plan agreed upon by Governments (UNEP, 1982; 1988). All Action Plans have the following components: **environmental assessment**, comprising baseline studies, research and monitoring of the quality of the marine environment and factors that may influence it; on **environmental management**, including training in assessment methodologies, ecosystem management, waste control and contingency plans to deal with emergencies; on **environmental legislation**, seeking legal commitments in form of regional conventions and related protocols; on **institutional arrangements**, providing secretariat and coordination functions; and on **financial arrangements** through which UNEP often provides seed financing until governments assume financial responsibility for a regional trust fund, usually administered by UNEP. Currently Action Plans exist in 12 regions; in the Asia-Pacific region, the three plans are the East Asian Seas Action Plan with headquarters in Bangkok (UNEP, 1983; 1987); the South Asian Seas Action Plan, adopted in March 1995 and operating under the secretariat of the South Asia Co-operative Environment Programme; and the North-West Pacific Action Plan, adopted in September 1996. While fisheries as such has been excluded from the agenda of the Action Plans to avoid overlap with mandate of the regional fisheries bodies, in many

cases emphasis is placed on integrated coastal area management, which, of course, has a direct link to fisheries and aquaculture.

All these groups and programmes, as well as the secretariats of many UN specialized agencies dealing with ocean affairs, contributed to the preparations for the 1992 United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro.

3. THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT

The United Nations Conference on Environment and Development, Rio 1992, (UNCED) recognized that *"The marine environment - including the oceans and all seas and adjacent coastal areas - forms an integrated whole that is an essential component of the global life-support system and a positive asset that presents opportunities for sustainable development"* (United Nations, 1993).

The importance attached to oceans can be further related to three important considerations:

- The growing tendency of the human population to agglomerate for socio-economic reasons in coastal zones, often within a narrow band of about 60 km, thus creating pressure on a potentially fragile environment and its ecosystems and resources, both coastal and marine.
- The evident progressive degradation of the marine and coastal natural resources under the combined effect of excessive rates of use and pollution.
- An ever-increasing awareness that the ocean is a basic governing force for life on this planet and that better understanding of its physical and biological mechanisms, including their interaction with atmospheric processes, is essential for wise decision-making aimed at sustainable development.

Chapter 17 of Agenda 21 agreed upon at UNCED, Protection of the Oceans and all Kind of Seas, including Enclosed and Semi-enclosed Seas and Coastal Areas and the Protection, Rational Use and Development of their Living Resources, is one of the more complex chapters in Agenda 21. It covers the following programme areas:

- (a) Integrated management and sustainable development of coastal areas, including exclusive economic zones.
- (b) Marine environmental protection.
- (c) Sustainable use and conservation of marine living resources of the high seas.
- (d) Sustainable use and conservation of marine living resources under national jurisdiction.
- (e) Addressing critical uncertainties for the management of the marine environment and climate change.

- (f) Strengthening international, including regional, co-operation and co-ordination.
- (g) Sustainable development of small islands.

Other chapters of Agenda 21 are also relevant to fisheries, e.g., Chapter 15, Conservation of biological diversity, which led to the Biodiversity Convention (United Nations, 1994).

4. PROGRESS IN THE IMPLEMENTATION OF AGENDA 21, CHAPTER 17

In a number of areas covered, significant progress has been made towards the implementation of Agenda 21.17, not least as a result of initiatives taken jointly by the UN system. Only a few examples of relevance to fisheries and the environment are referred to here (United Nations, 1996; Naeve and Garcia, 1995).

4.1 Marine environmental protection from land- and sea-based pollution

On the basis of the 1985 Montreal Guidelines for the Protection of the Marine Environment from Land-based Sources of Pollution, a **Global Programme of Action for the Protection of the Marine Environment from Land-based Activities** was prepared by UNEP, reviewed and revised by a meeting of Government-designated experts in Reykjavik in March 1995, and adopted in November 1995 in Washington (UNEP, 1995). This programme will provide the basis for national and international action on reducing ocean pollution from land-based activities, contributing, *inter alia*, to improving coastal habitats and productivity; reducing threats to food security and safety; and reducing hazards to human health.

Concerning pollution from sea-based sources, a number of activities were initiated by IMO in cooperation with other agencies. In 1993, the IMO Assembly adopted the **Code on the Carriage at Sea of Irradiated Nuclear Fuel and Other Nuclear Material (INF Code)**. In February 1994, **Amendments to the 1972 London Convention** entered into force prohibiting sea disposal of radioactive and industrial wastes and incineration at sea of industrial wastes and sewage sludge. Further, IMO is investigating ways by which ships ballast water can be controlled to avoid transfer of unwanted aquatic organisms and pathogens from one part of the world to another.

4.2 Sustainable use and conservation of marine living resources

The legal frameworks for sustainable use and conservation of living aquatic resources in the oceans have greatly improved since UNCED.

First of all, the **1982 United Nations Convention on the Law of the Sea** has been ratified by the required number of countries and entered into force in November 1994. It establishes the rights and duties of states and provides the basis for international agreements and dispute resolution in relation to fisheries in the high seas and in exclusive economic zones.

Second, the legally binding **Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas** (the "**Compliance Agreement**") was approved by the FAO Conference in November 1994 and has been signed by nine governments and the European Union to date (FAO, 1993).

Third, the **Agreement for the Implementation of the Provisions of the UN Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks**, which usefully complements the 1982 Convention, was adopted in August 1995 in New York and opened for signature on 4 December 1995 (United Nations, 1995).

Fourth, the **Code of Conduct for Responsible Fisheries**, which provides the guidance necessary for management and conservation of fishery resources as well as associated or dependant species, and their environment, has been developed by FAO Members and was approved by the FAO Conference in October 1995 (FAO, 1995). This was preceded in March 1995 by the **Rome Consensus on World Fisheries** (FAO, 1995a).

These initiatives were further followed up by the **Kyoto Declaration and Plan of Action on the Sustainable Contribution of Fisheries to Food Security** (Government of Japan/FAO, 1995).

4.3 Critical uncertainties for the management of the marine environment and climate change

Agreement has been reached on a development approach, strategy and time-frame for the **Global Ocean Observing System (GOOS)** of the Intergovernmental Oceanographic Commission (IOC), involving many national institutions and with the effective cooperation of WMO, UNEP and ICSU, the International Council of Scientific Unions (IOC/WMO/UNEP/ICSU, 1996). Several regional GOOS programmes have been initiated and there has been an increase in efforts to collect and share some critical types of data. In addition, significant progress has been made in numerous scientific domains critical to the understanding of the oceans, including the following:

- (a) Improvement of the ability to forecast changing environmental, ocean-related conditions (flooding, cyclones, tsunamis), and the capacity to apply such forecasts for warning and protective measures.
- (b) Updating the assessment of the ocean's role in regulating green-house gases concentrations, especially CO₂.
- (c) Completion of a series of case studies on the vulnerability of low-lying coastal areas and small islands to impacts of climate change and sea-level rise.
- (d) Evaluation of the impact of changing UV radiation on primary productivity of the marine environment.

- (e) Completion of the first three phases of the **Global International Mussel Watch Programme** and initiation of several follow-up phases.

4.4 Strengthening of international cooperation and coordination

The creation of the **ACC Subcommittee on Oceans and Coastal Areas** has facilitated and improved cooperation among bodies of the UN system, and, apart from joint integrated reporting on progress achieved in the implementation of Agenda 21, has become a forum for joint programming. As a first step, it will facilitate the co-operation of UN Agencies in the implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities.

GESAMP, the **IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection**, originally founded to advise solely on marine pollution issues, did broaden its terms of reference to be able to fully respond to the needs of its sponsoring agencies for scientific advice on all aspects of marine environmental protection and management.

5. MAJOR PROGRAMMES BEING IMPLEMENTED

The Fourth Session of the Commission on Sustainable Development, 18 April - 3 May 1996, received the progress report on Chapter 21,17 prepared by the ACC Subcommittee for Oceans and Coastal Areas for the Secretary-General of the United Nations. Besides confirming the coordinating role of the ACC Sub-committee and GESAMP's status as source of agreed, independent scientific advice, the report took note of all the different follow-up initiatives to UNCED, including the Jakarta initiative on Conservation and Sustainable Use of Marine and Coastal Biological Diversity of November 1995 (United Nations, 1996a) and the Call to Action of the International Coral Reef Initiative of June 1995 (ICRI, 1995). Furthermore, the report underlined the need for governments to fully participate in the implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, the Code of Conduct for Responsible Fisheries, and the Global Ocean Observing System.

5.1 Global Programme of Action for the Protection of the Marine Environment from Land-based Activities

The Global Programme of Action is designed to assist States in taking actions individually or jointly within their respective policies, priorities and resources, which will lead to the prevention, reduction and control of the degradation of the marine environment (UNEP, 1995). Effective implementation of this programme will promote the objectives and goals of sustainable development, focusing on pragmatic and integrated environmental management approaches and processes, such as integrated coastal area management, harmonized with river basin management and land-use planning.

The Programme identifies nine source categories and sets specific objectives and targets to be met.

With regards to **sewage**, by the year 2000, states are expected to establish waste treatment and disposal quality criteria, objectives and standards based on the nature and assimilative capacity of the receiving environment. By the year 2025, all sewage, waste waters and solid wastes should be disposed of in conformity with national and international environmental quality guidelines.

Emissions and discharges of **persistent organic pollutants** should be reduced or eliminated, giving immediate attention to the identification and introduction of substitutes for such substances. Cleaner production processes are to be introduced to reduce or eliminate hazardous by-products and wastes associated with production, incineration and combustion, e.g. dioxins, furans, hexachlorobenzene and polycyclic aromatic hydrocarbons. Further, best environmental practice for pest control in agriculture and aquaculture should be promoted.

A further objective is to reduce or eliminate emissions and discharges of **radioactive substances**, of **heavy metals**, and of **oil (hydrocarbons)**, in order to prevent, reduce and eliminate pollution of the marine and coastal environment.

Another source category are **nutrients**. The objective of the Action Programme is to identify marine areas where nutrient inputs are causing or are likely to cause pollution, to reduce nutrient inputs into the areas identified and to reduce the number of marine areas where eutrophication is evident. This is an area of particular interest since agricultural practices are a source of nutrient enrichment of coastal waters. Agricultural activities and deforestation contribute also to another category affecting the marine environment: **sediment mobilization**.

Litter threatens marine life through entanglement, suffocation and ingestion and is widely recognized to degrade the visual amenities of marine and coastal areas. The target by the year 2025 is that states should provide all urban areas with adequate waste collection, disposal and treatment services.

The increase of populations and economic activities in coastal areas is leading to **physical alterations and destruction of habitats**. The Programme aims at safeguarding the functions of coastal ecosystems, maintaining the integrity and biodiversity of habitats of major socio-economic and ecological interest through integrated management.

As a means of mobilizing experience and expertise, states should cooperate in the development of a **clearing-house mechanism**, a referral system through which decision makers at the national and regional level are provided with access to current sources of information. The clearing-house would consist of a data directory and information-delivery mechanisms. The data directory would include a component for each source category delineated in the Programme of Action, and, where possible, should build upon the work of international organizations like WHO, FAO, UNIDO etc.

While recognizing that states have the primary role in programme implementation, UNEP, through its secretariat role, will promote and facilitate implementation at national, regional and global level, in close partnership with other organizations.

5.2 The Code of Conduct for Responsible Fisheries

This Code sets out principles and international standards of behaviour for responsible practices to ensure the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. The Code recognizes the nutritional, economic, social, environmental and cultural importance of fisheries, and the interests of all those concerned with the fishery sector. The Code takes into account the biological characteristics of the resources and their environment and the interests of consumers and other users.

This Code is voluntary. However, certain parts of it are based on relevant rules of international law, including those reflected in the United Nations Convention on the Law of the Sea. It is global in scope and directed toward members and non-members of FAO, governmental and non-governmental organizations, fishing entities, and all persons concerned with the conservation of fishery resources and fisheries management, including fishers and the fish processing and marketing sectors.

The objectives of the Code are, *inter alia*, to promote protection of living aquatic resources and their environment. It states that users of living aquatic resources should conserve aquatic ecosystems. The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources. Selective and environmentally safe fishing gear and practices should be further developed and applied to maintain biodiversity, to conserve the population structure and aquatic ecosystems, and to protect fish quality. Where proper selective and environmentally safe fishing gear and practices exist, they should be recognized and accorded a priority in establishing conservation and management measures for fisheries.

States and users of aquatic ecosystems should minimize waste, catch of non-target species, and impacts on associated or dependent species.

All critical fisheries habitats in marine and fresh water ecosystems, such as wetlands, mangroves, reefs, lagoons, nursery and spawning areas, should be protected from destruction, degradation, pollution and other significant impacts resulting from human activities that threaten the health and viability of the fishery resources.

The Code requests states to establish effective procedures specific to aquaculture to undertake appropriate environmental assessment and monitoring, with the aim of minimizing adverse ecological changes and related economic and social consequences resulting from discharge of effluents, use of drugs and chemicals, and other aquaculture activities. Further, states should conserve genetic diversity and maintain integrity of aquatic communities and ecosystems by appropriate management. In particular, efforts should be undertaken to minimize the harmful effects of introducing non-native species or genetically altered stocks used for aquaculture and culture-based fisheries.

As an important guiding principle, the Code requires broad application of a precautionary approach to conservation, management and exploitation of living aquatic resources to protect them and preserve the aquatic environment, taking account of the best scientific evidence available. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation measures.

The precautionary approach recognizes that all fishing activities have environmental impacts, and that it is inappropriate to assume that these are negligible until proven otherwise (FAO, 1995b). The precautionary approach to fisheries requires that all fishing activities be subject to prior review and authorization, that a management plan be in place that clearly specifies management objectives and how impacts of fishing are to be assessed, monitored and addressed. The standard of proof to be used in decisions regarding authorization of fishing activities should be commensurate with the potential risk to the resource, while also taking into account the expected benefits of the activities.

5.3 The Global Ocean Observing System

The ability to determine the present state of ocean systems and predict their future conditions is the cornerstone for adequately protecting and managing ocean and coastal areas and for rational use and development of their living and non-living resources. Effective management of oceans and coastal areas is often limited by the high degree of uncertainty in currently available information. The Global Ocean Observing System (GOOS), initiated by IOC in cooperation with WMO, UNEP and ICSU, will help to overcome this problem (IOC/WMO/UNEP/ICSU, 1996).

GOOS is intended to provide a global framework for the gathering, coordination, quality control and distribution of all kinds of marine and oceanographic data of common utility and the generation of derived products to be defined by user groups. It will enable participating countries to make better use of their investment in ocean observations and research for all forms of maritime use. Through training and capacity building, GOOS will enable smaller or less developed countries to participate more actively in the management of their future. Because of the nature and evolution of the ocean, GOOS is conceived as a long-term operational system. It is the only framework being planned for the global coordination of ocean observations.

GOOS has to build on national requirements and is based on the principle that by encouraging nations to commit part of their national observational effort to a coordinated and integrated plan, benefits for all will accrue beyond the mere sum of the individual contributions. Economic studies will be undertaken to more precisely define and quantify the socio-economic benefits that could be derived from a fully implemented GOOS.

As a basis for organization, user-friendliness and ease of planning, GOOS has been articulated in terms of five "modules":

- Climate monitoring, assessment and prediction;
- Monitoring and assessment of marine living resources;

- Monitoring of the coastal environment and its changes;
- Assessment and prediction of the health of the ocean; and
- Marine meteorological and oceanographic operational services.

These modules are inter-related and will share observations, data networks and facilities, as needed, within the one integrated system. To respond to the particular needs of coastal area management, a specific module is planned, possibly jointly with GTOS, the Global Terrestrial Observation System.

Of particular interest to fisheries is the "Marine Living Resources" module, which includes the development of a system to monitor physical, biological and chemical variables needed to describe the structure and functioning of marine ecosystems, as well as changes in marine ecosystems over various space and time scales.

Sustainable development of living marine resources requires predictive capabilities. Predictions must take into account the effects of environmental changes on the abundance and production of these resources. Therefore, FAO is contemplating the development of a specific fishery resources component within the "Marine Living Resources" module of GOOS.

The first activities required from member states are to establish national mechanisms for GOOS planning and development in close collaboration with their marine user community groups; to define their national needs and priorities; and to strengthen national oceanographic facilities and data collection activities.

In the Asia-Pacific region a GOOS pilot programme has already been launched jointly by four countries: the North-East Asia Regional GOOS (NEAR-GOOS), concentrating so far only on improving collection and transmission of physical and chemical parameters.

6. CONCLUSIONS

Based on concerns raised during the last decades concerning the health of the marine environment, and with the active support of many international, UN and non-UN organizations, including non-governmental organizations, the 1992 United Nations Conference on Environment and Development set the scene for governments to strive for the sustainable utilization and development of the marine environment and its living resources. A number of international agreements and tools are now functional, e.g. the Biodiversity Convention, the Climate Convention, The Law of the Sea Convention, the Code of Conduct for Responsible Fisheries, the Global Ocean Observation System, the Global Programme of Action for the Protection of the Marine Environment, the numerous conventions under the UNEP Regional Seas Programme. Governments now need to adhere to these agreements and programmes through active participation and the translation of international agreements into national legislation and regulations, ensuring such regulations are enforced.

In the Asia-Pacific region, it is vital to re-emphasize that rapid economic development may not necessarily be sustainable. APFIC, therefore, should be

instrumental in facilitating regional cooperation to promote the Code of Conduct and other UN instruments, in order to enable member states to strengthen environmentally friendly fisheries development.

However, in order to prevent the transfer of environmental problems from the oceans to other sectors of the environment, all sectors need to be managed and protected on a holistic basis that minimizes the impact of anthropogenic activities on the whole environment. It is both scientifically unsound and ethically wrong to take measures to protect one sector of the environment without considering the implications of that action on other sectors or the accompanying costs and benefits. Thus, marine environmental protection must include mechanisms for comparing the benefits and detriments associated with options in other sectors (GESAMP, 1990a).

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