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Regional Seas

Ecosystem-based Management of Fisheries

Opportunities and challenges for coordination between marine Regional Fishery Bodies and Regional Seas Conventions

UNEP Regional Seas Reports and Studies No. 175

Prepared in cooperation with

FAO FIAT PANIS ACOPS

UNEP 2001

Note: This publication was prepared by UNEP and FAO in cooperation with ACOPS on the basis of input provided by the Advisory Committee of ACOPS. In this endeavor we greatly appreciate the inputs provided by Regional Seas Conventions and Action Plans and Regional Fishery Bodies.

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UNEP would like to dedicate this publication to Stjepan Keckes who, in the wake of the 1972 Stockholm Conference, was the key player in the creation, development and expansion of the UNEP Regional Seas Programme. For 15 years, his careful planning, his insight into the workings of the United Nations system, and his ability to persuade nations – some in conflict – to unite for the protection of their shared marine environment gave the programme a durable framework which endures to this day. The Regional Seas Programme now involves some 140 countries and continues to attract more.

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Back cover: map of the Regional Seas by Nikki Meith

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FOREWORD

To effectively manage our fisheries, we need to manage fish in the context of the environment in which they exist, that is an ecosystem. This means understanding the complex ecological and socioeconomic environments in which fish and fisheries exist. It also means anticipating the effects that fishery management will have on the ecosystem and the effects that ecosystem will have on fisheries.

Practical application of a comprehensive ecosystem-based fisheries management approach is still in its early stage of development by the regional organizations concerned with fisheries and the marine and coastal environment. It is time that these organizations grasp its potential for cooperation. This awareness must be expanded and actions taken to implement this approach.

This publication has been jointly developed between UNEP and FAO, with the technical assistance of the Advisory Committee on Problems of the Sea (ACOPS) and with inputs coming from Regional Seas Conventions and Regional Fisheries Bodies.

This paper was presented at the 3rd Global Meeting of the Regional Seas Conventions (RSCs), organized by UNEP in Monaco 6-9 November 2000 and at the 2nd Meeting of Regional Fisheries Management Organizations, at FAO Headquarters, in February 2001. The publication has also benefited from the inputs of the participants to these meetings.

The purpose of this publication is to present considerations which can serve as the basis for potential cooperation between RFBs and RSCs. It describes the concept of ecosystem-based fisheries management, the relevant mandates and activities of RFBs and RFCs and the relationship and mutual relevance of their work. Possible mechanisms for cooperation, and issues for future consideration, are identified. It is anticipated that such cooperation could best be implemented on a site-specific or regional basis, after initial consideration at the global level by RFBs and RSCs.

UNEP will embark during the following years in a process of collaboration with FAO to explore the opportunities and challenges for coordinated activities on ecosystem-based management of fisheries.

– Klaus Töpfer, Executive Director,
United Nations Environment Programme

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EXECUTIVE SUMMARY

The ecosystem approach to the management of oceans and their resources was consolidated in Agenda 21. Practical application of this approach is still in early stages of development by regional organisations respectively competent for fisheries, and for the marine and coastal environment. It was seen as a platform for potential cooperation between these bodies by the Subcommittee on Ocean and Coastal Areas of the UN Administrative Committee on Coordination. To this end, this paper has been developed jointly by FAO and UNEP for presentation, if agreed, at the 3rd Global Meeting of the Regional Seas Conventions in November 2000, and the 2nd Meeting of FAO and non-FAO Regional Fishery Bodies or Arrangements in February 2001.

A brief description of marine Regional Fishery Bodies (RFBs) and Regional Seas Conventions (RSCs) is presented, noting the origins, status, geographic coverage and basis for consideration of ecosystem approach by each. Establishment of RFBs has taken place throughout the past century, and most created since adoption of the United Nations Convention on the Law of the Sea (UNCLOS) in 1982 have clear management functions. Although only a small proportion have specific ecosystem-related mandates, all have scope to consider this approach in some form. Current challenges include developing the concept, objectives, indicators, reference points and implementation mechanisms, as appropriate in a climate of cooperation with other international organisations and each other.

Establishment of RSCs began relatively recently, in 1972. The eleven major Regional Seas Conventions in force that are designed for the protection of the marine environment are mostly in the form of "comprehensive framework conventions". Their protocols and annexes specify the concrete measures expected to be implemented by the parties, and "Action Plans" relate to all issues relevant to the development and protection of the marine environment and their resources. Periodic revisions of the Action Plans broadened their scope to emphasise issues contained in Agenda 21, such as integrated management. With a few exceptions, issues related to fisheries are among the only major issues that are not covered, or are covered only in a marginal way, by the action plans.

The development of the concept and rationale of ecosystem-based management of fisheries is described. Although broad ecosystem objectives appear in international instruments, and the approach forms part of some national laws/strategies and has been considered at global conferences, the practical application of the concept has only recently emerged as the subject of international attention. Two leading examples are the March 1999 symposium on "Ecosystem Effects of Fishing" convened by the International Council for the Exploration of the Sea (ICES), and the planned September, 2001 Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem. It is considered that implementation of the ecosystem approach would prompt changes to institutional, training, capacity, information, monitoring, evaluation, governance and regulatory requirements.

General provisions of the RSCs, and structure and strategies of the action plans are covered, noting that the latter usually include five main components: environmental assessment; environmental management; environmental legislation; institutional arrangements and financial arrangements. Five RSCs are described which contribute to the goals of fisheries management by dealing with the control of land-based sources and activities that may have deleterious effects on the marine environment, including its living resources. In almost all regions intensive monitoring of the quality of the marine environment is carried out, and the data can provide good background information for fisheries management.

Activities of RFBs relating to ecosystem-based management are described. The work of three leading RFBs is profiled, and a synthesis of RFBs' action presented. In general, the RFBs' activities relate to: the impact of fisheries on the ecosystem; the impact of other sectors on fisheries; the impact of climate and ozone depletion on fisheries; and ecosystem monitoring.

Actions for future consideration by RFBs include defining ecosystem objectives in parallel with the current conservation objectives of fisheries management. It is suggested that the new objectives should address biodiversity, habitat productivity and marine environmental quality. Some additional needs include the definition of indicators and reference points, and new monitoring activities and data products for the indicators.

The relationship and mutual relevance of the work carried out by RFBs and RSCs is reviewed, especially in areas relating to biodiversity of species, habitat, marine environmental quality, climate change, land-based pollution of the marine environment, and in the monitoring and assessment which applies to these areas.

It is suggested that as ecosystem considerations and indicator frameworks are increasingly factored into fisheries management, the functionalities of RFBs and RSCs will need to be adapted in a practical, cost-effective way to meet future needs. This could be done in a way that would not overburden either RFBs or RSCs, and build on current programmes. Some examples of activities which could form a basis for practical cooperation are suggested.

Taking into account current activities of RFBs and RSCs, as well as the experience gained through the cooperation already established between some RFBs and RSCs, concrete suggestions are made for options that may lead to enhanced cooperation on ecosystem-based fishery management.

PART I. PURPOSE AND INTENDED USE OF PAPER

1. The ecosystem approach to management of the oceans and their resources was consolidated in Agenda 21. Review and coordination of implementation of this area among United Nations agencies is facilitated by the Subcommittee on Ocean and Coastal Areas (SOCA) of the Inter-Agency Committee on Sustainable Development. They operate under the umbrella of the UN Administrative Committee on Coordination (ACC).

2. At its ninth session, in July 2000, SOCA considered the relevance of the regional setting for improving coordination among different UN programmes addressing different aspects of Coastal and Ocean Management. Its purpose was the exploration of new ways to integrate the work of the agencies and, in particular, to look for synergies between regional organisations respectively competent for fisheries, and for the marine and coastal environment. It was felt that the challenge posed by the development of ecosystem approaches to fisheries management and integrated coastal management could be considered by both types of bodies as a potential platform for practical cooperation.[1] The need for such coordination has also been recognised by marine Regional Fishery Bodies and UNEP in the recent past.[2]

3. As a first step in this direction it was agreed that a paper centered around ecosystem based management in fisheries would be jointly developed by FAO and UNEP. The purpose of the paper was to present considerations which can serve as the basis for potential cooperation between Regional Fishery Bodies (RFBs) and Regional Seas Conventions (RSCs). It described the concept of ecosystem-based fisheries management, the relevant mandates and activities of RFBs and RSCs and the relationship and mutual relevance of their work. Possible mechanisms for cooperation, and issues for future consideration, were identified. It was anticipated that such cooperation would be best carried out on a site-specific or regional basis, after the initial consideration at global level by RFBs and RSCs.

4. The paper was presented at the Third Global Meeting of the Regional Seas Conventions (RSCs), organised by UNEP (Monaco 6-9 November 2000) and the Second Meeting of FAO and Non-FAO Regional Fishery Bodies or Arrangements organised by FAO (Rome, 20-21 February 2001). The relevant parts of the reports of these meetings are attached as Annex 10 and 11.

[1] Draft Report of the ACC Subcommittee on Oceans and Coastal Areas on its Ninth Session, London 26-28 July 2000, paras 96 and 97.

[2] RFBs are, in general, concerned about the impacts from other sectors affecting fisheries, including land-based pollution and habitat, as well as the impacts of non-sustainable fishing or fishing techniques and climate. Their concerns and mutual cooperation, including in the context of biennial meetings of FAO and non-FAO Regional Fishery Bodies or Arrangements, initiated in 1999, are described in text below. UNEP has, on a formal basis addressed this as follows: (i) *The First Inter-Regional Programme Consultation* (The Hague, 24-26 June 1998) identified "the lack of necessary interaction with the fisheries sector and other socio-economic sectors" as one of the "most fundamental problems hampering the implementation of the respective Regional Seas Programmes" and recommended that "agreements should be reached to incorporate the implications and concerns of the fisheries sector in the programmes". (ii) *The Second Global Meeting on Regional Seas Conventions and Action Plans* (The Hague, 5-8 July 1999), considered how to "address more effectively the issue of the sustainable management of fisheries" by "integrating environmental considerations into the fishery sector". (iii) At the same meeting, the representative of the Alliance of Small Island States emphasised that a major challenge for SIDS is the need for development and management programmes aimed at achieving ecological and economical sustainable use of coastal and marine resources in several areas, including sustainable fisheries.

PART II. BRIEF DESCRIPTION OF REGIONAL FISHERY BODIES AND REGIONAL SEAS CONVENTIONS

A. Regional Fishery Bodies (RFBs)[3]

Origins

5. The tragedy of the commons – the overuse of common fishery resources because of the absence of a sufficiently strong system of cooperative and rational management – is the classic challenge to fisheries governance. The phenomenon often results from massive over-investment and subsidies in fisheries. The commons present, however, not only a tragedy but perhaps also an opportunity.

6. National authorities alone cannot protect areas that do not fall within their jurisdiction. International cooperation and legal regimes are the only ways by which global fisheries governance can be achieved effectively, although the problems obviously differ greatly from one region to another.

7. The need for such international cooperation contributed to the establishment of the first recorded marine RFB, the International Council for the Exploration of the Sea (ICES), in 1902. ICES has, as its mandate, the development of cooperation in scientific studies of the North Atlantic marine environment and its resources through cooperation among scientists. It is an advisory body, with an ecosystem reach.

8. Following the establishment of ICES, a number of other RFBs were established including, notably: the International Commission for Scientific Exploration of the Mediterranean Sea in 1919 and the North American Council for Fishery Investigations in 1920. The findings of these bodies led to regulatory action through the conclusion of a number of conventions.[4] ICES and some of the other bodies established in the first half of the century, particularly before 1945, concentrated their efforts on the generation of scientific information and the promotion of scientific cooperation with emphasis on the conservation of fishery resources.

9. During the second half of the century, however, world fisheries governance has been radically and rapidly transformed through a series of international initiatives with a corresponding increase in the number of Regional Fishery Bodies, the mandates of which exceed, in many cases, those assigned to bodies established earlier in the century.

10. The process began with the creation of the Food and Agriculture Organization (FAO) as a specialised Agency of the United Nations in 1945 with a clear mandate to contribute to the development and management of fisheries at the international, regional and national levels. This was followed by the First UN Conference on the Law of the Sea (UNCLOS) in Geneva in 1958. The four Geneva Conventions adopted by the First UNCLOS marked an important shift in the long history of high seas fishing at least in two main respects: the freedom to fish became clearly restricted by the duty to cooperate in the conservation of fishery resources and the collective responsibility of States in the conservation and utilisation of high seas resources was strengthened. The Geneva Conventions were revised and markedly expanded by the Third UNCLOS which concluded the work with the adoption of the UN Convention on the Law of the Sea.

11. In the past one hundred years approximately forty Regional Fishery Bodies have been established. The evolution of these bodies corresponds to the three distinct phases of the evolution of international fisheries in the twentieth century: the pre-UNCLOS period 1902-1950, the Law of the Sea negotiating period 1951-1982, and the post-Third UNCLOS period.

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[3] For the purposes of this paper, a regional fishery body refers to a mechanism through which three or more States or international organisations that are parties to an international fishery agreement or arrangement collaboratively engage each other in multilateral management of fishery affairs falling within their areas of competence, through the collection and provision of scientific information and data, serving as a technical and policy forum, or taking decisions pertaining to the development and conservation, management and responsible utilisation or the resources. This paper relates only to marine, and not freshwater, RFBs because of their mutual interests with RSCs. See Report of the Meeting of FAO and non-FAO Regional Fishery Bodies or Arrangements, FAO Fisheries Report No. 597, FIPL/R597, para 1, footnote 1.

[4] Examples include: North-East Atlantic Fisheries Convention of 24 January 1959 and Convention for the Regulation of the Meshes of Fishing Nets and the Size Limits of Fish.

12. Most bodies established in the pre-UNCLOS period such as ICES lay emphasis on the gathering of scientific information and the promotion of scientific collaboration. Several bodies established during the Law of the Sea negotiating phase have basically advisory powers but may also have regulatory powers with respect to conservation and management issues, whereas almost all bodies established after the adoption of the 1982 Law of the Sea Convention have clear management functions.

Status

13. There are presently 30 active marine Regional Fishery Bodies, seven of which have been established under the FAO Constitution. A list of these RFBs appears in Annex 1. FAO has also facilitated the establishment of several of the other bodies and serves as the depositary for the instrument of acceptance of such bodies. FAO bodies are established either under Article VI or Article XIV of the FAO Constitution.

14. In addition to Regional Fishery Bodies, some regional economic organisations usually termed "Arrangements" are also concerned with specific aspects of fisheries.[5]

15. The mandates of RFBs may be either to (i) provide advice (i.e., advisory functions), and/or (ii) take decisions concerning the conservation, sustainable management and use of one or more species, as well as the affiliated aspects of fisheries in a defined region or sub-region (i.e. regulatory functions). Many Regional Fishery Bodies are currently reviewing and adapting their mandates to address emerging issues enumerated in recent international instruments.

Geographic Coverage

16. Some RFBs have mandates based on geographic areas, and others have mandates for specific species, usually together with a description of the geographic area where they occur. The geographical area of RFBs may cover high seas and/or members' zones of national jurisdiction. All oceans, and some major seas, are covered by RFBs. The geographical areas of RFBs and RSCs appear superimposed on the map in Annex 2.

Basis for Consideration by RFBs of Ecosystem Approach

17. Very few RFBs have direct reference to an ecosystem approach to fisheries or species management in their conventions or other mandate, but all have scope to consider it in some form. [6]

18. The first meeting of FAO and non-FAO Regional Fishery Bodies in February, 1999 addressed two areas which relate to the ecosystem approach – international instruments and the exchange of information and other collaboration. These included:[7]

- ways for RFBs to promote the implementation of the recent series of international instruments and initiatives;
- improved means of promoting the precautionary approach to fisheries management;
- better mechanisms for the exchange of information among RFBs, and between RFBs and FAO;
- the prospects for closer collaboration between RFBs on a geographic or species basis and means to improve such collaboration; and
- mechanisms to promote further the global coordination of the activities of RFBs.

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[5] Examples include: Asia-pacific Economic Cooperation (APEC), Association of Southeast Asian Nations (ASEAN), Andean Pact, Caribbean Community and Common Market, Commonwealth of Independent States, Central African Customs and Economic Union (UDEAC), Economic Community of West African States (ECOWAS), European Community (EC), League of Arab States, Organization for Economic Cooperation and Development (OECD), South Pacific Forum (SPF),

[6] CCAMLR, ICES and PISCES have an ecosystem-based mandate, while CCSBT and NASCO are mandated to take into account ecologically related species. Examples of other RFBs which have incorporated a form of ecosystem-based management into their work programme are GFCM, IATTC, IBSFC, IPHC, IWC, NPAFC and SPC. NASCO is emphasizing the related pillars of habitat protection and the precautionary approach. For details, see Part V, *infra*.

[7] Report of the Meeting of FAO and non-FAO Regional Fishery Bodies or Arrangements, note 3, *supra*, paras 6 – 11. For further background see Swan, "Regional Fishery Bodies and Governance: Issues, Actions and Future Directions" FAO Fisheries Circular No. 959, FIPL/C959, 2000.

19. Discussion at the meeting indicated increasing collaboration among RFBs on a range of issues relevant to ecosystem approach to fisheries management. In particular, the topic of ecosystem considerations was included in discussions of common problems and possible solutions.[8] In this context, some RFBs reported that the by-catch and discard issues were being examined, but difficulties are being experienced in implementing ecosystem management. It was suggested that a subsequent meeting of RFBs could consider relevant themes such as pollution and environmental degradation, aquaculture and the introduction of foreign and transgenic species on fisheries and fisheries management.

20. Although many RFBs are rapidly making improvements in responding to new approaches to fisheries management, many challenges remain,[9] especially developing the concept, objectives and implementation of an ecosystem approach to fisheries management. This will call for increased cooperation among each other, and with other international organisations and programmes.

B. The Regional Seas Conventions

Origins

21. The regional approach to the marine environment is not new. Initially it focused on bilateral and multilateral agreements related to regulation of navigation and fishing. However, starting from the late 1960s, with the growing concern about marine pollution, it was recognised that – along the existing and evolving global agreements[10] – effective marine pollution control should be sought through region-specific agreements.

22. The first agreement of this type was successfully negotiated and adopted in 1972 (Oslo Convention). A strong boost to the development of similar agreements was given by the United Nations Conference on Human Environment (Stockholm, 1972) and by the negotiations of the United Nations Convention on the Law of the Sea.

23. UNEP played a leading role in initiating or supporting the negotiations of a number of Regional Seas Conventions and provided the initial financial resources needed for their implementation, but there is also a number of conventions that evolved without UNEP's assistance.

Status

24. Presently, there are eleven major Regional Seas Conventions in force that are designed for the protection of the marine environment: Helsinki (1974), Barcelona (1976), Kuwait (1978), Abidjan (1981), Lima (1981), Jeddah (1982) Cartagena (1983), Nairobi (1985), Noumea (1986), Bucharest (1992) and OSPAR (1992)[11]. In addition to the conventions in force, there are two Regional Seas Conventions under negotiation: one for the Caspian Sea and another for the Northeast Pacific. Information on the major Regional Seas Conventions and agreements that may be relevant to the possibilities of cooperation with RFBs on enhancement of an ecosystem-based management of fisheries appears in Annex 3.

Geographic coverage

25. The conventions cover the maritime areas under the jurisdiction of the contracting parties to these conventions, with the exclusion of internal waters in most cases. However, some conventions or the provisions of certain protocols or annexes associated with the conventions also apply to internal waters and, in one instance, even to the hydrologic basin and ground waters associated with the convention area.[12]

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[8] *Ibid.*, paras. 34-40.

[9] For more extensive discussion on these areas and RFB governance, see Swan, *op.cit.* note 7.

[10] e.g., the International Convention for the Prevention of Pollution of the Sea by Oil (adopted in 1954, London); the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (adopted in 1972, London); the International Convention for the Prevention of Pollution from Ships, adopted in 1973, London).

[11] The OSPAR Convention supersedes the Oslo (1974) and Paris (1978) Conventions.

[12] The geographic area covered by the Protocol concerning Specially Protected Areas and Wildlife of the Cartagena Convention includes: *(i) waters on the landward side of the baseline from which the breath of the territorial sea is measured and extending, in the case of watercourses, up to the fresh water limit; and (ii) such related terrestrial areas (including watersheds) as may be designated by the party having sovereignty and jurisdiction over such waters.*

Basic provisions of the conventions

26. Most of the Regional Seas Conventions considered in the present document, particularly those negotiated under the aegis of UNEP, are in the form of "comprehensive framework conventions", with articles of quite general nature which in themselves would have been of little practical value. However, these conventions are supplemented with several protocols and annexes specifying the concrete measures expected to be implemented by the contracting parties.

27. A number of regional conventions, particularly those adopted in early 1970s, were amended or even entirely revised in order to reflect the broadening concern of the contracting parties for the complex problems of the marine environment.[13] The most radical change was the merging of two conventions into a new convention.[14] Further revisions and amendments are being considered for some conventions.[15]

28. The evolving concern for the protection of the marine environment is reflected in the various protocols and annexes that have been associated with the conventions. Initially they focused on cooperation in cases of pollution emergencies and control of pollution caused by dumping but today they cover a much broader gamut of issues.[16]

Action plans: programmes of implementation

29. All Regional Seas Conventions are associated with specific programmes (most frequently in the form of an "Action Plan") supporting the implementation of the convention and protocols provisions. While the focus of the first action plans was on the protection of the marine environment from pollution, the subsequently adopted action plans shifted their priorities to all issues relevant to the development and protection of the marine environment and their resources. The periodic revisions of the action plans broadened their scope in order to emphasise issues related to integrated management and use of coastal and marine environment along the lines recommended by Agenda 21 adopted at the United Nations Conference on Environment and Development (UNCED). In some regions determined efforts are being made to pay more attention to the specific problems of small island states, to the management of associated river basins and to the potential effects of climate change.

30. With a few exceptions, issues related to fisheries are among the only major issues that are not specifically covered, or are covered only in a marginal way, by the action plans.

31. The periodic meetings of the contracting parties to the Regional Seas Conventions or, when the action plans are not associated with such conventions, periodic high-level intergovernmental meetings represent the highest authority guiding the action plans, determining the priorities which should be dealt by the plans and allocating the financial resources to these activities.

Secretariats and coordination

32. UNEP provides the secretariat for four conventions and seven action plans described in the present document, either directly through its Headquarters or through semiautonomous "regional coordinating units" managed by UNEP.[17] The other seven conventions and action plans have secretariats established and maintained by the contracting parties to these conventions.[18]

[13] The amendments and revisions (Barcelona, 1995; Helsinki, 1992) broadened the scope of the conventions, and modified the geographic area covered by one of the conventions.

[14] The OSPAR 1992 Convention is more than a "mechanical" merger of the Oslo 1974 and Paris 1978 Conventions. While the latter Conventions were designed to deal with the control of pollution caused by dumping and land-based sources, OSPAR 1992 is dealing, as signified by its title, with the protection of the marine environment in a broader context.

[15] e.g., for the 1985 Nairobi Convention.

[16] For example of the type of protocols see the description of he Barcelona Convention in Annex 3.

[17] UNEP also coordinates and assists the development of two additional conventions (Caspian Sea and Northeast Pacific), an additional action plan (Northeast Pacific) and a "cooperative programme" (Upper South-West Atlantic).

[18] For more details about the secretariats see Annex 3.

PART III. ECOSYSTEM-BASED MANAGEMENT OF FISHERIES

A. Concept and Rationale

Background

33. The concept and rationale of ecosystem-based management of fisheries – which takes into account the interrelationships between the planet's web of life and ongoing human action – emerged in the 1982 United Nations Convention on the Law of the Sea (UNCLOS). Although specific reference to "ecosystem" management only appears in relation to rare or fragile ecosystems,[19] the provisions on fisheries management describe ecosystem-like considerations to be taken into account, such as associated and dependent species, interdependence of stocks and minimum standards at all levels.[20] Instruments agreed at the 1992 United Nations Conference on Environment and Development – Agenda 21 and the Convention on Biological Diversity (CBD) – refer more specifically to the ecosystem approach, and this was carried forward by the 1995 United Nations Fish Stocks Agreement[21] and the 1995 Code of Conduct for Responsible Fisheries. The latter calls for the integration of fisheries into coastal area management, including the fragility of coastal ecosystems.[22]

34. The concept has been adopted by some RFBs[23] and national governments.[24] In addition, global conferences on fisheries have, over the past decade, identified concerns which could be addressed in part by an ecosystem approach to fisheries management.[25] The recently developed International Plans of Action (IPOAs) on various aspects of fishing reflect countries' determination to manage a range of important issues with ecosystem implications in compliance with the Code of Conduct for Responsible Fisheries.[26]

35. ICES convened a Symposium in March, 1999 on the Ecosystem Effects of Fishing.[27] It contributed significantly to the understanding of the concept and offers some practical guidance on the application of the ecosystem approach.[28] The value of the Symposium's work is further enhanced by what appeared to be the broad consensus that:

> *"the present approach to achieving conservation objectives of fisheries activities, even if successfully implemented, would not achieve yet to be defined ecosystem objectives. There is not, however, consensus amongst scientists on what additional restrictions are required, nor on what features of ecosystems need to be protected."*[29]

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[19] Article 194(5).

[20] In particular, Articles 61 and 62.

[21] Agreement for the Implementation of the Provisions of the United Nations 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.

[22] Article 10.1.1.

[23] See note 6, *supra*.

[24] Three leading countries engaged in developing and implementing the ecosystem approach to fisheries management in national law are Australia, Canada and the United States.

[25] International Conference on Responsible Fishing, Cancun, Mexico (Cancun Declaration on Responsible Fishing) 1992; Ministerial Conference on Fisheries (Rome Consensus on World Fisheries) 1995; Kyoto Conference on Sustainable Contribution of Fisheries to Food Security (The Kyoto Declaration and Plan of Action), 1995; World Food Summit (Rome Declaration on World Food Security and World Food Summit Plan of Action), 1996.

[26] These include the IPOAs for reducing incidental catch of seabirds in longline fisheries, for the conservation and management of sharks and for the management of fishing capacity. An IPOA on Illegal, Unreported and Unregulated Fishing was considered at an FAO Technical Consultation in October, 2000.

[27] Papers are published in the ICES Journal of Marine Science, "Ecosystem Effects of Fishing" Vol. 57, No. 3, June 2000.

[28] The scope of the Symposium embraced three themes: (1) a global synthesis of fisheries impacts in different ecosystems; (2) an overview of the methods available for quantifying ecosystem impacts; and (3) the integration of fisheries and environmental management. *ibid*., p. 470.

[29] See Sinclair M., O'Boyle R., Burke, L., and D'Entrement, S., "Incorporating Ecosystem Objectives within Fisheries Management Plans in the Maritime Region of Atlantic Canada", paper prepared for ICES CM 1999/Z:03, which refers to conclusions of Keith Sainsbury at the ICES Symposium. See also Gilsason H., Sinclair M., Sainsbury K and O'Boyle R, "Symposium Overview: Incorporating Ecosystem Objectives within Fisheries Management" ICES Journal of Marine Science, *op. cit.* note 27 p. 468. The latter suggests that the reason why the single species management is likely to fail is because this approach does not include monitoring the appropriate information to assess and evaluate achievement of ecosystem objectives.

Description

36. Although the concept of ecosystem-based management of fisheries has been adopted by some RFBs, their approaches vary, as noted in Part IV of this paper. In general, they are concerned about the impacts from other sectors affecting fisheries, including land-based pollution and habitat, as well as the impacts of non-sustainable fishing techniques and practices on the ecosystem.[30] In addition, considerations relating to biodiversity and the effect of climate on the fisheries are recognised as important.

37. It is evident that the fisheries ecosystem is extremely complicated. Most ecosystems contain a great number of species, and the number of potential biological and economic interactions increases exponentially with the number of species.[31]

38. There is currently no consensus on criteria for defining ecosystem overfishing, nor on a hierarchy of biological attributes for which ecosystems should be managed.[32] However, it has been suggested that ecosystem considerations may be incorporated into fisheries management by modifying existing overfishing paradigms or by developing new approaches to account for ecosystem structure and function in relation to harvesting. In particular, existing concepts of overfishing do not provide direct guidance on issues such as biodiversity, serial depletion, habitat degradation and changes in the food web caused by fishing.[33]

39. It has been suggested[34] that ecosystem considerations do not need to substitute for existing overfishing concepts. Instead, they should be used to evaluate and modify primary management guidance for important fisheries and species. In practice they emphasise the need to manage fishing capacity, supported by broader use of technical measures such as marine protected areas and gear restrictions.

40. Finally the concept of ecosystem management is related to the question of geographical boundaries of the ecosystem. Their definition can be a somewhat arbitrary process, dependent upon the particular interests of the ecologists and the details of the issue being addressed. An appropriate approach would need to be adopted for consideration of specific ecosystem features and associated human activities that would accommodate areas which may be larger or smaller than needed for ecosystem and fisheries considerations.[35]

B. Objectives

41. Recent international instruments[36] describe broad ecosystem objectives for the marine environment:[37]

- Manage marine living resources sustainably for human nutritional, economic and social goals;
- Protect and conserve the marine environment;
- Use preventive, precautionary and anticipatory planning and management implementation;
- Protect and maintain the relationships and dependencies among species;
- Conserve genetic, species and ecosystem biodiversity.

[30] These could include aquaculture, as well as by-catches, predator-prey demands and side-effects of fishing effort. See Murawski, S.A., "Definitions of Overfishing from an Ecosystem Perspective", ICES Journal of Marine Science, *op. cit.* note 27, p. 657.

[31] See Arnason, R., "Economic Instruments for Achieving Ecosystem Objectives in Fisheries Management", ICES Journal of Marine Science, *op.cit*, note 27, p. 750. It is concluded that despite the dynamics, volatility and general unpredictability, it is possible to manage ecosystem fisheries in a useful manner by aiming for the best possible management. In this context, management based on property rights is suggested.

[32] Murawski, S.A., *op. cit.* note 30, p. 650.

[33] *Ibid.*, p. 649.

[34] *Ibid.*

[35] See Sinclair M., O'Boyle R., Burke, L., and D'Entrement, S., "Incorporating Ecosystem Objectives withing Fisheries Management Plans in the Maritime Region of Atlantic Canada", *op. cit.* note 29, p. 6. The authors suggest a nested approach would be required for the consideration of specific ecosystem features and associated human activities.

[36] In particular, UNCLOS, Agenda 21 and the CBD.

[37] See Sainsbury K.J., Punt A.D. and Smith A.D.M., "Design of Operational Management Strategies for Achieving Fishery Ecosystem Objectives" ICES Journal of Marine Science, *op. cit.* note 27, p. 731.

42. These need to be translated into practical objectives, which can be defined in parallel with presently used conservation objectives of fishery management plans. The objectives should focus on the maintenance of biodiversity, habitat productivity and marine environmental quality as conditions for the long-term sustainable development of fisheries. [38]

43. It has been suggested that the biodiversity objective will need to include several components, such as ecosystem and species diversity, genetic variability within species and species at risk. The habitat productivity objective will need to address directly impacted species, ecologically dependent species and trophic level considerations. Once the objectives are set, the next steps are to provide the respective performance measures and reference points. Examples of ecosystem objectives, indicators and reference points are shown in Annex 4.[39]

44. Implementation of such objectives will require strengthened monitoring systems, evaluation processes and governance.

C. Advantages

45. The advantages of an ecosystem-based approach to fisheries management both meet, and extend beyond the realms of sustainable fisheries, biodiversity, habitat protection, and all other objectives described above.

46. The ecosystem approach acknowledges the paradigm shift in the management of all natural resources, and the increasing need to integrate fisheries and environment management objectives,[40] as well as human and ecosystem well-being Movement towards such integration, coupled with a precautionary approach, would allow managers to distance themselves from the current "fire fighting approach"[41] in favour of a more holistic approach.

47. Taking into account the functions of marine ecosystems to convert and transfer solar energy, and sustain all life on the planet, an ecosystem approach would encourage the scientific community to proactively quantify potential effects of fishing and other activities on the energy flow through marine ecosystems.[42] Assessment of the potential effects of other human activities on the fisheries resource would also be encouraged.

48. The ecosystem approach to fisheries and environmental management would gather energy, inspiring development of appropriate scientific and related standards. It would also prompt changes to institutional, training, capacity, information, monitoring, evaluation, governance and regulatory requirements.[43] It could serve as a model for environmental management of other sectors whose activities affect, and are affected by, the marine environment.

49. Ecosystem management is enhanced by the coming Millennium Ecosystem Assessment, designed to determine the condition of global ecosystems and to analyze the capacity of an ecosystem to provide goods and services important for human development.[44] When the capacity is diminished, fisheries and those dependent on them are affected.

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[38] See Sinclair M., O'Boyle R., Burke, L., and D'Entrement, S., "Incorporating Ecosystem Objectives within Fisheries Management Plans in the Maritime Region of Atlantic Canada", *op. cit.* note 29, and Gilsason H., Sinclair M., Sainsbury K., and O'Boyle R., "Symposium Overview: Incorporating Ecosystem Objectives within Fisheries Management", *op. cit.* note 29, p. 472. The objective of marine environmental quality does not appear in these references but was suggested in conversation by Michael Sinclair.

[39] See Sinclair M., O'Boyle R., Burke, L., and D'Entrement, S., "Incorporating Ecosystem Objectives within Fisheries Management Plans in the Maritime Region of Atlantic Canada", *op. cit.* note 29, Table 1.

[40] See Richardson K., "Integrating Environment and Fisheries Management Objectives in the ICES Area: Reflections of a Past ACME Chair", ICES Journal of Marine Science *op. cit.* note 27, p. 766, and West, M., "The Future of the International Law of Capture Fisheries", Northwest Atl. Fish. Sci., vol. 23 Symposium papers pp. 19-25, October 1998.

[41] Examples of this type of approach are found in Richardson, *ibid.*, note 31, p. 767. For example, requiring ships to carry clean ballast water, to prevent pollution of the ocean when it is discharged, presented another ecosystem threat – introduction of alien species, sometimes with disastrous consequences. Examples are the release of zebra mussels in the Great Lakes, of toxic phytoplankton cysts into regions previously free of toxic blooms and of *Mnemiopsis* spp. in the Black Sea, leading to a collapse of the local fishery.

[42] See Richardson, *ibid.,* p. 769.

[43] See Fluharty D., "Habitat Protection, Ecological Issues and Implementation of the Sustainable Fisheries Act", Ecological Applications, 10(2):325-337, April 2000.

[44] This effort was organised and supported by UN Agencies, and leading scientific organisations, and was launched at the UN General Assembly in September 2000. For more information, see http://www.ma-secretariat.org.

50. One benefit of this integrated ecosystem assessment programme is that it provides the information necessary to weigh trade-offs among various goods and services and to identify opportunities for benefits. Information and data collected in ecosystem-based fisheries management could be input into this assessment, and the relative importance of fisheries strengthened.[45]

D. Impact of non-Fishery Activities on the Ecosystem

51. Assessment and management of the impact of non-fishery activities on the ecosystem is important to ecosystem-based fisheries management. Where marine environmental concerns once centered on pollution, it is now recognised that pollution is neither the only, nor necessarily the most severe threat to the health of oceans and coasts.[46] A range of human activities are producing devastating effects on the marine environment, as described in detail by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP).[47]

52. Continuing pollution problems are, however, still widespread. Sewage is a major problem, especially when it includes industrial wastes, and many contaminant chemicals are inadequately regulated.

53. Land-based activities pose a range of threats to the marine environment.[48] Examples of these are agriculture, forestry, coastal construction, urban development and tourism.[49] Sewage discharge and the runoff of nutrients, sediments and pesticides present greater risks to human health and the marine environment than radioactivity and heavy metals, given existing controls.[50]

54. However, as severe as pollution may be, GESAMP reports that human activity resulting in the routine modification and exploitation of marine and coastal environments, and the widespread habitat damage and loss that result, probably pose even greater threats.

55. One example of this is coastal development, which is taking place at a rapid rate.[51] It both increases pollution, and radically alters coastlines. Clearing, land reclamation and channelisation of flood and tidal waters destroy coastal wetlands. Port development, road building, coastal construction and the mining of beach sand for construction material obliterate shoreline habitats. Coastal and marine tourism and mariculture – the farming of shellfish and finfish – also contribute substantially to pollution of the marine environment and habitat destruction.

56. A second example is over-exploitation of renewable resources, which results in part from coastal population growth and development. Increased demand for fish, and often more fishers, has led to the over-exploitation of most coastal fisheries and to the destruction of a significant part of coastal forests.

57. It is widely recognised that efforts to identify and manage or combat these activities on an ecosystem basis need to be continued.

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[45] For example, a decision to convert a forested area to agriculture could make sense when considering only foregone timber values and increased food production. But it may not be economically justified when impacts on the quantity and quality of water and on freshwater and coastal fisheries are factored in. See *ibid*.

[46] Some pollution control initiatives, when applied and enforced, have often succeeded in curbing marine pollution. These initiatives have focused on regulating pollution sources, banning the use of certain chemicals such as PCBs, and prohibiting the ocean disposal of entire categories of waste including industrial waste and radioactive materials. Reducing lead in automobile fuel, for example, has led to lower levels of lead in ocean surface waters. See note 47, *infra*.

[47] The material in this section of the paper is drawn from two recent GESAMP reports published by UNEP: A Sea of Troubles, Rep. Stud. GESAMP No.70, 52 pp; and Protecting the Oceans from Land-Based Activities, Rep. Stud. GESAMP No.71, 292 pp. About GESAMP see http://gesamp.imo.org/ocean.htm.

[48] This fact led over 100 countries to adopt the 1995 Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA/LBA). The implementation of the Programme is coordinated by UNEP. For more detail see http://www.gpa.unep.org

[49] They are major sources of plant nutrients and sediments which threaten the health of marine and coastal environments, and of contaminants such as pesticides and oil. See note 47, *supra*.

[50] See http://gesamp.imo.org/ocean.htm.

[51] Some 44% of the world's population lives within 150 km of the coast – more people than inhabited the entire planet in 1950. Mass migration to the coasts will continue in the decades ahead. This population growth is concentrated in large coastal cities. *Ibid*.

PART IV. PROVISIONS OF THE REGIONAL SEAS CONVENTIONS AND THE ACTIVITIES OF ASSOCIATED ACTION PLANS RELEVANT TO ECOSYSTEM-BASED MANAGEMENT OF FISHERY RESOURCES

A. General Provisions of the Conventions

58. The general obligations specified in all conventions are to prevent, reduce, abate, combat and control pollution in the convention area. Some conventions also include obligations to preserve rare and fragile ecosystems, as well as habitats of depleted, threatened and endangered species. The specific obligations common to most conventions include:

- control of pollution caused by dumping, discharges from ships, exploration and exploitation of continental shelf and land based sources;
- cooperation in cases of emergencies;
- scientific and technical cooperation, including joint monitoring and research programmes, data and information exchange, and technical assistance;
- adoption of procedures for determining the liability and compensation for damage resulting from violation of the convention or its protocols;
- reporting on measures adopted in implementation of the conventions at national levels.

B. Structure and Strategies of the Action Plans

59. Most action plans, particularly those adopted under UNEP's aegis, follow a structure similar to the one adopted for the Action Plan for the Human Environment at UNCHE (Stockholm, 1972), although specific activities for any region are dependent upon the needs and priorities of that region. The action plans usually include the following five main components:

(a) Environmental assessment. This concerns assessing and evaluating the sources and causes of environmental problems as well as their magnitude and impact on the marine environment. Emphasis is given to such activities as: baseline studies; research and monitoring of the sources, levels and effects of marine pollutants; ecosystem studies; studies of coastal and marine activities and social and economic factors that may influence, or may be influenced by, environmental degradation. Environmental assessment is undertaken to assist national policy makers to manage their natural resources in a more effective and sustainable manner, and to provide information on the effectiveness of legal and administrative measures taken to improve the quality of the environment.

(b) Environmental management. Each regional programme includes a wide range of activities in the field of environmental management. Examples of such activities are: preparation of sub-regional and site specific integrated coastal zone management plans; formulation of contingency plans for dealing with environmental emergencies; establishment and management of specially protected areas; pollution reduction programmes; and training to allow national institutions and experts to participate fully in the programme.

(c) Environmental legislation. Each convention is associated by at least one protocol or annex that provide the legal basis for action in specific field of the conventions' application. With the broadening scope of the conventions, they are periodically amended/revised and additional protocols and annexes are added to them.

(d) Institutional arrangements. When adopting the action plan, the governments agree upon an organisation to act as the permanent secretariat of the action plan and the mechanisms to be used for the periodic review of the progress of the agreed work-plan and for approving new activities and the necessary budgetary support.

(e) Financial arrangements. The contributions of the governments toward the costs associated with the implementation of the conventions and the action plans are usually channelled through specially established trust funds to which the governments participating in the action plan make annual contributions.

60. The overall strategy followed by most regional seas action plans includes, with slight modifications:

- Promotion of international and regional conventions, programmes, guidelines and actions for the control of activities leading to the degradation of the marine and coastal environment and for the protection and management of marine and coastal resources on a sustainable basis.
- Assessment of the state of the marine and coastal environment, of the trends in the quality of this environment, of the sources of the degradation of the marine and coastal environment, and of the impact of this degradation on human health, ecosystems and amenities.
- Promotion of integrated management of geographic areas covered by the conventions and their protocols.
- Support for education and training efforts to make possible the full participation of developing countries in the implementation of the conventions and in activities envisaged under the action plans.

C. Activities relevant to ecosystem-based management of fisheries

61. Although the majority of the Regional Seas Conventions specify their concern for the status of marine living resources and emphasise the need for their protection, none of the conventions deals in a major way with the protection or management of fishery resources. Nevertheless, some of the convention provisions, and particularly some of the protocols and action plans associated with the conventions could be seen as contributing directly or indirectly to these goals.

62. Five conventions (Barcelona, Bucharest, Cartagena, Kuwait, Lima) are associated with protocols dealing with the control of land-based sources and activities that may have deleterious effects on the marine environment, including its living resources. Protocols or annexes dealing specifically with specially protected areas, endangered species and biodiversity are attached to six conventions (Barcelona, Cartagena, Kuwait, Lima, Nairobi, OSPAR). Some of the biodiversity-related protocols include specific reference to fisheries and to activities relevant to the management of fisheries resources.

63. In addition to the provisions of these two groups of protocols that could be seen as contributing the legal basis for an ecosystem-based approach towards the management of the marine environment, almost all action plans adopted the integrated coastal management as the most promising approach to the solution of the problems besetting the regions covered by the conventions.

64. In almost all regions intensive monitoring of the quality of the marine environment is carried out and the results are used for the preparation of periodic reports on the state of the marine environment. The data presented in these reports are used by the parties to the conventions as a basis for designing measures for the protection of the marine environment. Although the reports only marginally and in exceptional cases[52] deal with issues of direct relevance to fishery management, they provide a good background information that may have to be taken into account in ecosystem-based management of fisheries.

65. In addition to the regional state of environment reports of general nature, in several regions specific regional and site specific assessments were prepared about: (i) the impact of climate change on the coastal and marine environment; (ii) the status of coral reefs and wetlands and (iii) the impacts of land-based sources and activities on the marine environment. Many of these impact assessments contain sections dealing with actual and potential impacts on fishery resources.

66. Specific examples for past, ongoing or planned regional activities that are directly or indirectly relevant to the management of fishery resources are provided in Annex 5.

[52] See section on the OSPAR Convention on the following pages.

PART V. ACTIVITIES OF REGIONAL FISHERY BODIES RELATING TO THE ECOSYSTEM APPROACH TO FISHERIES MANAGEMENT

A. Background

67. "Environment" was first seriously considered in connection with fisheries management by an RFB in the 1970s. ICES responded to public concern about the environmental threats from chemical contamination. One obvious concern was whether the fish harvested for human consumption might present a health risk for the consumer. ICES responded by establishing the Advisory Committee on Marine Pollution(ACMP) in 1972.[53] At that time, "environment" was used almost exclusively to mean contaminant chemistry and biology.[54]

68. In more recent years, the concept of environment has expanded to merge with the concept of ecosystems. As noted above, much work still needs to be done to: identify the objectives, indicators and reference points of ecosystem management, including fisheries; establish the programmes, monitoring, training, capacity and other elements needed for implementation; to identify the ecosystems themselves; and to establish an appropriate system of governance.

69. This is balanced by current realities of fisheries managers. Their immediate concerns include: conservation of resources; control of catches and effort; fleet capacity; by-catch and discards; data and information collection analysis and distribution; illegal, unreported and unregulated (IUU) fishing; and monitoring, control and surveillance.[55] Habitat and marine environmental quality are also of concern, but often responsibility is shared with environmental managers.

70. The instruments establishing the RFBs do not generally accord a mandate for ecosystem-based fisheries management. Those which do either refer to (i) ecosystem-based management – including CCAMLR and two initiatives, establishing new RFBs in the South-East Atlantic and Western Central Pacific oceans;[56] or (ii) management of ecologically related species – including the NPAFC Convention, which mandates scientific research, cooperation, information requirements and consideration by the Commission of "ecologically related species", and the CCSBT Convention, which provides for the collection and exchange of data and other information relevant for scientific research on ecologically related species. To this end, the CCSBT has established an ecologically related species working group.[57]

71. However, as noted above, there is consensus in the scientific community that ecologically-based management of fisheries can build upon existing management systems and programmes, with identification of objectives, indicators, reference points and the activities, capacity and governance necessary to support such management. It is simply an extension of the RFB's existing mandate. Exemplary in this realm is the current IBSFC policy for sustainable fishing in the Baltic Sea, based on a comprehensive plan which was elaborated by IBSFC in consultation with HELCOM and ICES.

72. Current fisheries management systems and programmes of RFBs which relate to ecosystem-based management and which could be used as a starting point for future progress and cooperation, are profiled and synthesised below. They respond to the needs of the relevant RFB, and depend to a great extent on their mandates and individual capacity to collect and consider the appropriate knowledge.[58]

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[53] ACMP was replaced with the Advisory Committee on the Marine Environment in 1992.

[54] Richardson K., *op. cit.* note 31, p. 767.

[55] For further information on these issues in the context of fisheries governance, see Swan, *op. cit.*, note 7.

[56] Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean singed in April 2001 (see Preamble, Articles 1 and 3, draft as at February 2000), and the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Region (see Preamble, Articles 5, 12, 13, signed in September 2000).

[57] The working group has, among other things, developed guidelines for the design and use of tori lines as devices for deterring sea birds from taking bait during the setting of lines for longline fishing operations. Ecosystem management issues have been raised in the Commission, but firm strategies have not been developed to date. The secretariat reports that this matter will need to be considered further, in the context of the Commission's powers and responsibilities under the Convention.

[58] The disparity in capacities of RFBs to develop such knowledge is becoming more widely recognised and addressed, including with the support of the UNCED – inspired Global Environmental Facility (GEF) and the Living Oceans Programme.

73. They cover a wide range of interests, and focus on: (i) the impact of fisheries on the ecosystem (including protection of species and habitat, impact of gear and/or non-target, associated and dependent species (NADS), aquaculture, marine debris); (ii) the impact of other sectors on fisheries; (iii) oceanic ecosystems/climate/ozone depletion; and (iv) monitoring/feedback management procedures.

74. The work of three leading RFBs – ICES, CCAMLR and IBSFC – will first be presented as case studies, and the management systems and programmes of other RFBs will then be synthesised.

B. Pioneering Work of the International Council for the Exploration of the Sea (ICES), the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the International Baltic Sea Fishery Commission (IBSFC)

International Council for the Exploration of the Sea (ICES)

75. The leading advisory RFB in this field is ICES – an international science organisation studying and helping to safeguard North Atlantic marine ecosystems and the living resources they sustain.[59] A major area of its work is to provide information and advice to its 19 member countries and international regulatory commissions. It considers its vision as being an international scientific community that is relevant, responsive, sound and credible with respect to marine ecosystems and their relation to humanity. Its scientific goals include:

- quantifying marine environmental processes and their variability;
- determining implications of climate variability on ecosystem dynamics;
- characterizing biological diversity and its role in ecosystem functioning; and
- enhancing knowledge on populations of living resources focusing on the biological scientific understanding that is a prerequisite for a well founded ecosystem approach to fisheries.

76. ICES is working on the development of the basis for ecosystem approaches in fisheries, especially the management of fish stocks. This work has a very long tradition in the organisation with multispecies working groups dealing with interactions in the fish compartments of various locations, including the North Sea, Baltic Sea, Barents Sea and the sea around Iceland. It has also worked on the links between other compartments of the ecosystem and the fisheries.[60]

77. An integral part of ICES scientific work, the aim is to improve the scientific foundation for understanding the function of the ecosystem, and to improve the quality and widen the scope of the advice on fisheries management. In 2000-2001 ICES is focusing on the Baltic ecosystem as a suitable test case.

78. In the first half of 2001, ICES plans to further the discussion of ecosystem objectives – not confined to fisheries – through a directed effort involving several working groups and their expertise. In addition to these broader programmes, ICES has addressed specific issues in recent years on an advisory basis, including the interactions between fish and sea birds and fisheries effects on the marine benthos.

79. Most important, ICES wants to focus on the ecosystem aspects of the impact of fisheries, and to this end has been internally analysing the structure of its advisory function over recent years. Possible changes to this advisory structure is being discussed at the ICES Council statutory meetings.[61]

80. ICES' achievements over the years inspired establishment of PICES – the North Pacific Marine Science Organization – whose purposes include promoting and coordinating marine research in the northern North Pacific and adjacent seas, and advancing scientific knowledge about the ocean environment, global weather and climate change, living resources and their ecosystems and the impacts of human activities.

[59] The information which follows was provided in a communication from Hans Lassen, Fisheries Adviser, ICES.

[60] ICES has established three working groups addressing different aspects of the marine ecosystem and has published results in a range of reports and journals, including the ICES Journal of Marine Science.

[61] It is on the agenda for the September 2000 Statutory Meeting.

Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)

81. CCAMLR, which came into force in 1982, was established in response to patterns of intense and sporadic pulses of exploitation of Antarctic marine living resources and the consequent severe depletion of harvested stocks.[62] It does not impose regulations, but rather attempts to reach agreement on issues which members are then obliged to implement.

82. The Convention applies to all marine living resources[63] inside a designated area of the Southern Ocean, which is substantially a closed ecosystem. It is based on principles of conservation, which include reference to a precautionary approach and an ecosystem approach.[64] In the application of the ecosystem approach, CCAMLR has tackled the difficulty of describing the full complexity of marine ecosystems by assuming that the system is dominated by the complex of species most important in the food chain.

83. To regulate harvesting in accordance with the ecosystem approach, CCAMLR has recognised that the effect of harvesting on dependent species[65] would have to be monitored. It began to plan its CCAMLR Ecosystem Monitoring Program (CEMP) in 1984, with the following aims:[66]

- to detect and record significant changes in critical components of the ecosystem to serve as a basis for the conservation of Antarctic marine living resources; and
- to distinguish between changes due to harvesting of commercial species and changes due to environmental variability, both physical and biological.

84. The program's largest component is the monitoring of dependent species, but in order to distinguish between changes due to harvesting and those due to environmental variability, the program also monitors harvested species, harvesting strategies and environmental parameters.

85. CCAMLR recognises that regulating large and complex marine ecosystems is a task for which we currently have neither sufficient knowledge nor adequate tools.[67] Instead, CCAMLR's approach is to regulate human activities (e.g. fishing) so that deleterious changes in the Antarctic ecosystems are avoided.

86. It has been suggested that CCAMLR still needs to develop appropriate management procedures to avoid localised effects on the ecosystem and to provide effective feedbacks on the effects of fishing through its monitoring programme.[68]

International Baltic Sea Fishery Commission (IBSFC)

87. The IBSFC Action Program for the Sustainable Development of the Fishery was crafted as a result of the 1996 Baltic prime ministerial level conference.[69] The conference adopted the Presidency Declaration, followed by the foreign ministers' Kalmar Communique. The latter requested updating and strengthening of HELCOM. The Action Programmes adopted at Kalmar requested, inter alia,

> *"the development of a coherent policy for sustainable fishing in the Baltic Sea based on a comprehensive plan to be elaborated by the International Baltic Sea Fishery Commission in consultation with HELCOM and ICES."*

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[62] This was the case for fur and elephant seals in the 19th century, and whales and finfish in the 20th century. More recently, in the mid-1970s, it was realised that the conservation of krill was fundamental to the maintenance of the Antarctic ecosystem and vital to the recovery of depleted whale populations.

[63] Except seals in a designated area and whales in general.

64 Article II.

[65] Species which are predators on the commercially harvested species, such as birds and seals.

[66] For further information, see www.ccamlr.org.

[67] It considers an "ecosystem" to be any unit that includes all of the organisms in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structures, biotic diversity and material cycles (i.e. exchange of materials between living and non-living parts) within the system. It sees an "ecosystem approach" as not concentrating solely on the species fished but also seeks to minimise the risk of fisheries adversely affecting "dependent and related" species – i.e. species with which humans compete for food. *Ibid*.

[68] Constable, A.J., de la Mare, W.K., Agnew, D.J., Everson I., and Miller D., "Managing fisheries to conserve the Antarctic marine ecosystem: practical implementation of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)", ICES Journal of Marine Science, *op. cit.* note 27, p. 1054.

[69] In Visby, 1996. For more details, see Part 4 of this paper.

88. As a consequence, the IBSFC Action Program for Sustainable Development of the Fisheries has emerged as the leading example of cooperation between RSCs and RFBs. It melds the concepts of sustainable fisheries and ecosystems in its definition of sustainable fisheries: "Sustainable, productive fisheries are achieved when appropriate management ensures a high probability of stocks being able to replenish themselves over a long period of time within a sound ecosystem, while offering stable economic and social conditions for all those involved in the fishing community."

89. The goals for sustainable fisheries are defined, and indicators are provided to highlight the trends in biological systems and the economies of the fishery dependent communities around the Baltic. These appear in Annex 6.

90. IBSFC endorses guiding principles as pertinent to sustainable fisheries. These appear in Annex 7 and include further integration of fisheries and environmental protection, conservation and management measures, drawing, so far as scientific knowledge permits, on an ecosystem approach encompassing the following:

- the identification of processes in, and influences on, the ecosystems which are critical for maintaining their characteristic structure and functioning, productivity and biological diversity;
- recognition of the interaction among the different components of food-webs of the ecosystems (multi-species approach) and other important ecosystem interactions; and
- providing for an environment in these ecosystems which protects those critical ecosystem processes.

91. Ecosystem considerations are also part of IBSFC's larger package, and useful for guidance in other geographical areas. These are appended in Annex 8, and include:

- interaction of pollution and fish stocks;
- the need to reduce pollution with negative impacts on fish stocks;
- impact of eutrophication;
- impact of pollutants;
- impact of human activity on fish stocks;
- global warming;
- impact of fisheries on the ecosystem: the need to protect species and habitats.

92. The IBSFC Action Program for sustainable development of the fishery presents a range of ecosystem-related actions, including developing long-term strategies for major fish stocks, improving the management of resources in the Coastal Areas, increasing cooperation in control and enforcement and improving the quality of stock and fisheries assessment.

93. Research is a vital part of the Action Program. In the context of stock assessment, it is noted that further research on interaction between fisheries and other components of the ecosystem is necessary, and to that end, the plan calls for improvement of research surveys and biological sampling, and improvement of management decisions by providing socio-economic data to complement scientific assessments, including further research on interactions between fish and associated/dependent species, and on ecosystem effects of fishing (like possible negative effects of various fishing techniques). This approach to research could serve as an example which could be useful in other geographical areas.

C. Synthesis of RFBs Action

94. A synthesis of RFBs activities in relation to ecosystem-based fisheries management is presented in Annex 9, which supplements the information above and gives examples of actions and strategies adopted by some RFBs which relate to ecosystem-based management of fisheries.[70] These can serve as a basis for further development of ecosystem-based fisheries management, and a springboard for future cooperation, including for example the development of objectives, research, strategies and further actions.

[70] The synthesis presents a reasonably comprehensive picture, rather than a catalogue, of current and past actions. There may be some related actions of RFBs which do not appear, but which can be identified in future discussions.

95. The RFB activities described in Annex 9 fall under the following general headings, and are summarised below.

- the impact of fisheries on the ecosystem;
- the impact of other sectors on fisheries;
- the impact of climate and ozone depletion on fisheries
- ecosystem monitoring

96. The impact of fisheries on the ecosystem is viewed from different perspectives by RFBs. Of the four headings described above, this arena is most active, and tends to focus on the resource. Many RFBs link this to the protection of species, and some are concerned with habitat. The impact of aquaculture on the marine environment is also considered in this context. Relevant activities of RFBs described in Annex 9 include monitoring, the collection and exchange of data, the impact of gear on non-target species and the marine ecosystem, reduction of by-catch, scientific research on and consideration of ecologically-related species, introductions and transfers, habitat issues, the impact of aquaculture, application of the precautionary approach, convening a Symposium on the impacts of fisheries on the ecosystem, and an educational campaign for fishers.

97. Activities relating to the impact of other sectors on fisheries is an area which most RFBs have neither the mandate nor resources to explore in depth. Few RFBs have dedicated attention to this area, other than to research the effects of chemical pollutants, and identify considerations relating to activities which have a large combined effect on the biodiversity of species and habitats, such as the utilisation of coastal and offshore waters for activities such as aquaculture, shipping, recreation, electric or engineering projects, dredging, dumping, extraction of gravel and sand, and oil prospecting.

98. Activities relating to the impact of climate and ozone depletion on fisheries include research on the effects of environmental changes on stocks and developing assessment methods and management strategies that are robust to environmentally driven changes in the fish stocks.

99. An ecosystem monitoring programme has been established by one management-oriented RFB,[71] and a feedback management procedure incorporating a variety of ecosystem-related factors has been adopted by another.[72] Three scientific advisory bodies are engaged in various forms of ecosystem monitoring.[73]

D. Actions for Future Consideration by RFBs

100. Action by RFBs towards ecosystem-based fisheries management has largely focused to date on the impacts of fishing on the ecosystem – particularly that part of the ecosystem related to fishing such as NADS, gear selectivity and habitat. The climatological and oceanographic factors affecting the marine ecosystem have attracted more study than identification of the effects of other human activities on the fisheries ecosystem, and overall marine environmental quality. This is likely due to two compelling reasons – RFBs generally lack the mandate and human/financial resources to consider this. It is an area for future cooperation with RSCs, as described in Part VI of this paper.

101. As noted in Part II of this paper, RFBs could consider defining ecosystem objectives in parallel with the current conservation objectives of fisheries management. The new objectives will need to address biodiversity and habitat productivity. In addition, indicators and reference points will need to be defined, and new monitoring activities and data products will be required for the indicators. Evaluation of the degree to which aggregate industrial activities are meeting ecosystem objectives, and resolution of user conflicts will need to be catered for.[74]

[71] CCAMLR.

[72] IWC.

[73] ICES, PISCES and SPC.

[74] See Sinclair *et. al, op. cit.* note 29.

PART VI. RELATIONSHIP AND MUTUAL RELEVANCE OF THE WORK CARRIED OUT BY RFBS AND RSCS

102. The relationship between the work of the RFBs and RSCs reflects the growing nexus between fisheries and environmental management – as well as the holistic nature of life on this planet. Underpinning this relationship are the concepts and obligations of recent international instruments which apply to both, as described in Part II. [75]

103. The *raison d'être* of most RFBs is to achieve agreement on the conservation and management of a resource which knows no boundaries. The need for such bodies is underlined by the fact that fourteen have been established since the adoption of UNCLOS, with two more waiting in the wings. Most have regulatory functions, but are still striving to recover from the continuous decline of stocks, often beyond the level corresponding to sustainable yield. To this end, many are taking some dynamic new steps, such as:[76]

- adopting the obligations and management concepts in international instruments;
- cooperating/collaborating on an increasing basis;
- reviewing and strengthening their mandates;
- adopting management strategies – or increasing research – which takes ecosystem considerations into account, especially those which relate to the impact of fishing on the marine ecosystem;
- increasingly taking into account the effect of ecosystems on marine resources, especially climate related factors;
- proactively working to secure the compliance by non-members to their management measures;
- proactively creating intelligence networks and adopting trade and other measures to discourage such activities as illegal, unreported and unregulated fishing;
- improving data collection and analysis.

104. However, there are some potential constraints which confront RFBs in implementing an ecosystem approach. As noted above, RFBs have not, in general, focused on the impact of other human activities on the marine ecosystem and the fisheries resource due largely to absence of mandate, capacity and other resources. In addition, in most developing countries (and even in some developed ones) the present capacity is insufficient to deal effectively with conventional management of fisheries. The higher costs implied by ecosystem-based management represent, therefore, a significant challenge.

105. Another potential constraint is the lack of any existing coordination and cooperation within countries between national sectors (ministries) dealing with fisheries and environmental protection. In some cases they jealously guard their "mandates" and they even act as adversaries rather than partners.

106. As noted in Part 4, RSCs carry out the following activities, all of which are relevant to the ecosystem-based management of fisheries:

- monitoring and assessment of land-based pollution;
- protected areas;
- endangered species;
- biodiversity;
- integrated coastal management;
- intensive monitoring of marine environmental quality;
- assessments on impacts of climate change and land-based pollution on the coastal/marine environment.

[75] These are: manage marine living resources sustainably for human nutritional, economic and social goals; protect and conserve the marine environment; use preventative, precautionary and anticipatory planning and management implementation; protect and maintain the relationships and dependencies among species; conserve genetic, species and ecosystem biodiversity.

[76] For details, see Swan, *op. cit.* note 7, and Lugten, G., "A Review of Measures Taken by Regional Marine Fishery Bodies to Address Contemporary Fishery Issues", FAO Fisheries Circular No. 940, FIPL/C940, Rome, April 1999.

107. The ongoing work of RFBs and RSCs is mutually relevant in many respects, particularly in areas of biodiversity of species, habitat, marine environmental quality, climate change and land-based pollution of the marine environment, and in the monitoring and assessment which applies to these areas. Fisheries-related activities concerning protected areas and endangered species are also mutually relevant.

108. The IBSFC precedent is still in early stages of implementation, but demonstrates potential scope for coordination between RFBs and RSCs. There are no other current examples of such coordination. Most RFBs and RSCs operate, for the most part, independently of one another. In many cases, their respective capacities and resources are tailored to the management of specific human impacts on the marine ecosystem.

109. The development of fisheries research has been, over the past decades, intense and sophisticated. The need to broaden conventional fisheries management beyond its traditional parameters will redefine the research and management framework, priorities and approaches. This will lead progressively to the integration of conventional fishery research (with its intense use of modelling) with the use of indicator frameworks, accelerating the convergence with environmental management and sustainable development approaches.

110. As ecosystem considerations and indicator frameworks are increasingly factored into fisheries management, the functionalities of RFBs and RSCs will need to be adapted in a practical, cost-effective way to meet future needs. This could be done in a way that would not overburden either RFBs or RSCs, and build on current programmes.

111. Options for mutual starting points to explore the scope for cooperation are suggested in Part VII, and eventually RFBs and RSCs may wish to consider a range or practical matters. There is potential for cooperation in many forms, such as the identification of collaborative goals and geographical areas, sharing of relevant information and data directly or through such mechanisms as website linkages, development of mutual ecosystem considerations, development of integrated sustainability indicator frameworks which promote complementarity, and adapting monitoring or information systems to support ecosystem-based fisheries management.

112. However, the first steps in moving towards such potential cooperation must first be taken. The opportunity for joint recognition of common problems and complementary mandates exists in the global fora of RFBs and RSCs. Initial views as to the opportunities and challenges for cooperation could be considered, together with the feasibility of such cooperation. The more specific objectives and forms of cooperation could be considered at regional level.

PART VII. CONCLUSIONS AND POSSIBLE OPTIONS

113. At present there are 11 major Regional Seas Conventions in force and two additional conventions are being negotiated. They are designed for the protection of the marine environment, including its living resources, under the jurisdiction of the contracting parties to these conventions. Ninety-nine sovereign States and the European Union are parties to one or several of the conventions in force. Geographically, the conventions cover large parts of the most productive and most threatened areas of the oceans. None of the conventions deals with the management of fishery resources although a number of activities carried out in the framework of programmes associated with the conventions are directly or indirectly relevant, and may contribute to improved management of fishery.

114. There are presently 27 active marine Regional Fishery Bodies, seven of which have been established under the FAO Constitution. FAO has also facilitated the establishment of other bodies and serves as the depository for the instrument of acceptance of such bodies. Negotiations are ongoing for the establishment under the FAO Constitution of a regional fishery commission in the Southwestern Indian Ocean. In September 2000, the Convention for the Establishment of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Central and Western Pacific Ocean was adopted. Negotiations are well advanced for the establishment of the Southeast Atlantic Fisheries Organization.

115. The convergence of fisheries management and ecosystem management paradigms and requirements is a reality. Its steadily growing acceptance and implementation is reflected in the ongoing activities described in this paper, and in new initiatives such as the 2001 Reykjavik Conference on Responsible Fisheries in the Ecosystem.[77] With the increasing establishment of new information technology and systems which offer integrated ecosystem assessment,[78] it is imperative that regional bodies build on their strengths and successes to date, evaluate future needs, and begin work on a mutually beneficial framework for cooperation.

116. The preceding sections of the present paper review the status of the RFBs and the RSCs, with specific reference to their activities that may be relevant for improved cooperation between them. Taking into account these activities, as well as the experience gained through the cooperation already established between some RFBs and RSCs, the following concrete suggestions are made for options that may lead to an enhanced cooperation on ecosystem-based fishery management:

- Formalise the observer status of the RSCs at the meetings of the governing bodies of the RFBs and their technical subsidiary organs, and vice versa.
- Exchange data and information available at the level of RFBs and RSCs that may be of mutual interest.
- Establish joint advisory panels and organise joint technical meetings on subjects of mutual interest, as is presently the case between Helsinki and Ospar Commissions and ICES.
- Create formal agreements (e.g. memoranda of understanding) between relevant RSCs and RFBs specifying the scope and modalities of cooperation.
- Seek association and cooperation with the regional components of global programmes providing data and information relevant to ecosystem-based fishery management, such as GOOS (see Annex 12) and GPA/LBA.
- Design and implement joint programmes between RFBs and RSCs taking fully into account the respective mandates, objectives and scope of the RSCs and RFBs.

[77] This will take place in Reykjavik, Iceland, 24-28 September 2001.

[78] For example, the Millennium Ecosystem Assessment.

ANNEX 1. LIST OF REGIONAL MARINE FISHERY BODIES

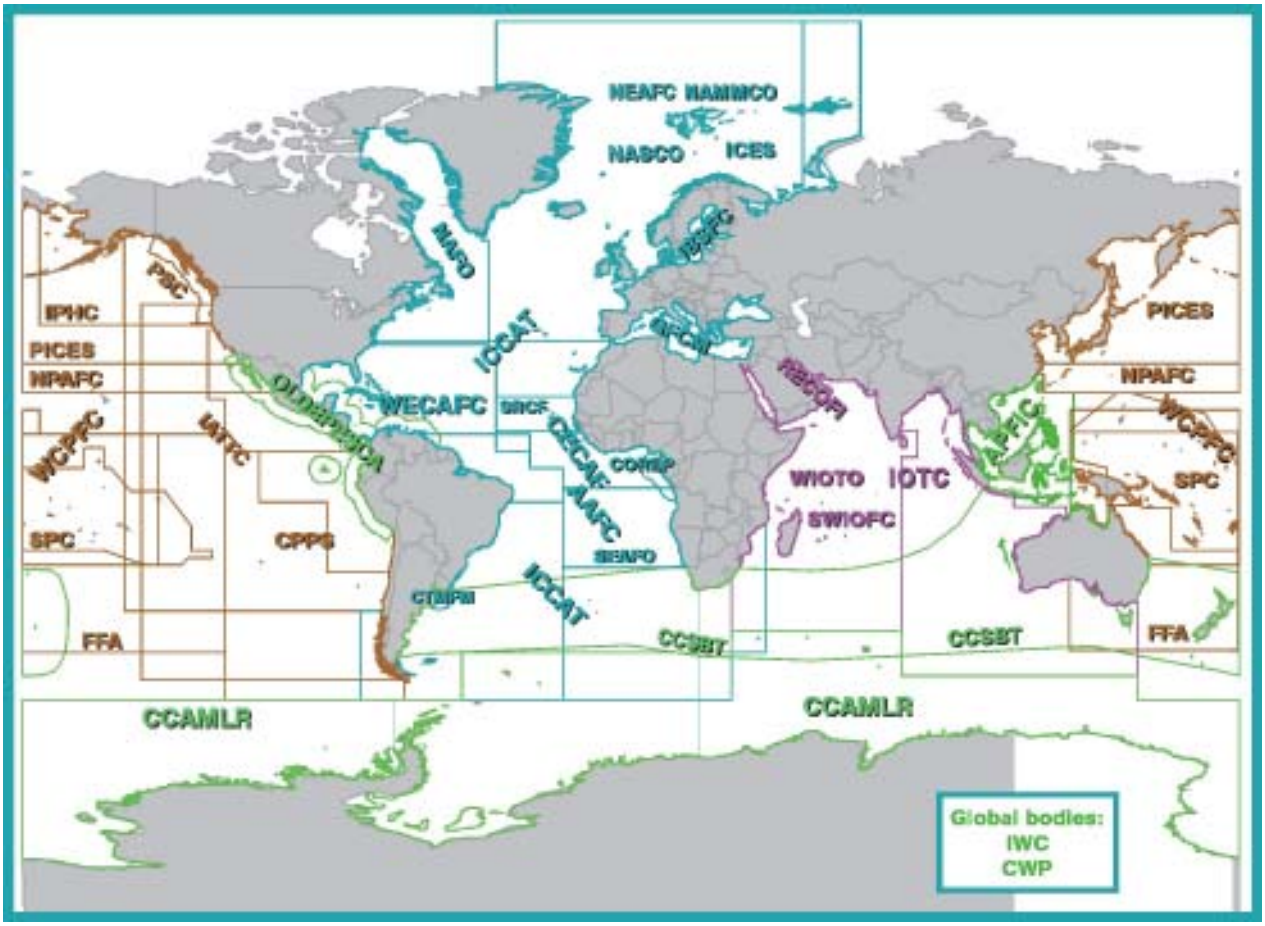
FAO Bodies

APFIC	Asia-Pacific Fisheries Commission
CECAF	Fishery Committee for the Eastern Central Atlantic
CWP	Coordinating Working Party on Fishery Statistics
GFCM	General Fisheries Commission for the Mediterranean
IOTC	Indian Ocean Tuna Commission
RECOFI	Regional Commission for Fisheries (not yet in force)
SWIOFC	South West Indian Ocean Fishery Commission (not yet finalised)
WECAFC	Western Central Atlantic Fishery Commission

Non-FAO Bodies

AAFC	Atlantic Africa Fisheries Conference
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
COREP	Regional Fisheries Committee for the Gulf of Guinea (not yet in force)
CPPS	South Pacific Permanent Commission
CTMFM	Joint Technical Commission for the Argentina/Uruguay Maritime Front
FFA	South Pacific Forum Fisheries Agency
IATTC	Inter-American Tropical Tuna Commission
IBSFC	International Baltic Sea Fishery Commission
ICCAT	International Commission for the Conservation of Atlantic Tuna
ICES	International Council for the Exploration of the Sea
IPHC	International Pacific Halibut Commission
IWC	International Whaling Commission
NAFO	Northwest Atlantic Fisheries Organization
NAMMCO	North Atlantic Marine Mammal Commission
NASCO	North Atlantic Salmon Conservation Organization
NEAFC	North-East Atlantic Fisheries Commission
NPAFC	North Pacific Anadromous Fish Commission
OLDEPESCA	Latin American Organization for the Development of Fisheries
PICES	North Pacific Marine Science Organization
PSC	Pacific Salmon Commission
SEAFO	South East Atlantic Fishery Organization (not yet in force)
SPC	Secretariat of the Pacific Community
SRCF	Sub-regional Commission on Fisheries
WCPFC	Western and Central Pacific Fisheries Commission (not yet in force)
WIOTO	Western Indian Ocean Tuna Organization

ANNEX 2. MAP OF REGIONAL MARINE FISHERY BODIES



PACIFIC OCEAN REGION

CPPS	Permanent South Pacific Commission/ Commission permanente du Pacific Sud
FFA	South Pacific Forum Fisheries Agency
IATTC	Inter-American Tropical Tuna Commission
IPHC	International Pacific Halibut Commission
NPAFC	North Pacific Anadromous Fish Commission
PICES	North Pacific Marine Science Organization
PSC	Pacific Salmon Commission
SPC	South Pacific Commission
WCPFC	Western and Central Pacific Fisheries Commission

ATLANTIC OCEAN REGION

AAFC	Atlantic Africa Fisheries Conference
CECAF	Fishery Committee for the Eastern Central Atlantic
COREP	Regional Fisheries Committee for the Gulf of Guinea
CTMFM	Joint Technical Commission for the Argentina/ Uruguay Maritime Front
GFCM	General Fisheries Council for the Mediterranean
IBSFC	International Baltic Sea Fishery Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
NAFO	Northwest Atlantic Fisheries Organization
NAMMCO	North Atlantic Marine Mammal Commission
NASCO	North Atlantic Salmon Conservation Organization
NEAFC	Northeast Atlantic Fisheries Commission
SEAFO	South East Atlantic Fishery Organization
SRCF	Sub-Regional Commission on Fisheries
WECAFC	Western Central Atlantic Fishery Commission

INDIAN OCEAN REGION

IOTC	Indian Ocean Tuna Commission
RECOFI	Regional Commission for Fisheries
SWIOFC	South West Indian Ocean Fisheries Commission
WIOTO	Western Indian Ocean Tuna Organization

GLOBAL AND TRANS-OCEANIC

APFIC	Asia-Pacific Fisheries Commission
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CWP	Coordinating Working Party on Fishery Statistics
IWC	International Whaling Commission
OLDE-PESCA	Latin American Organization for the Development of Fisheries

ANNEX 3. REGIONAL SEAS CONVENTIONS AND PROGRAMMES

This Annex lists and provides basic information on the major Regional Seas Conventions, agreements and programmes that may be relevant in considering the possibilities for cooperation with Regional Fishery Bodies on enhancement of ecosystem-based management of fisheries.

A. CONVENTIONS IN FORCE AND THEIR PROGRAMMES

Abidjan Convention

- Title: Convention for Cooperation in the Protection and development of the Marine and Coastal Environment of the West and Central African Region – adopted in 1981; in force since 1984
- Parties (21)[79] : Angola, Benin, **Cameroon,** Cape Verde, **Congo, Cote d'Ivoire,** Democratic Republic of Congo, Equatorial Guinea, **Gabon, Gambia, Ghana, Guinea,** Guinea-Bissau, Liberia, Mauritania, Namibia, **Nigeria,** Sao Tome and Principe, **Senegal,** Sierra Leone and **Togo**[80]
- Depositary: Cote d'Ivoire
- Geographic coverage: The marine environment, coastal zones and related inland waters falling within the jurisdiction of the States of the West and Central African Region, from Mauritania to Namibia inclusive, which have become Contracting Parties to the Convention.
- Associated protocols: (1) Protocol concerning Cooperation in Combating Pollution in Cases of Emergency
- Associated Action Plan: Action Plan for the Protection and Development of the Marine Environment and Coastal Areas of the West and Central African Region – adopted in 1981
- Secretariat: Regional Coordinating Unit for the West and Central African Action Plan (WACAF/RCU), UNEP, c/o Ministry of Construction and Environment, 20 B.P 650, Abidjan 20, Cote d'Ivoire, tel (225) 202 111 83 or 202 106 23, fax (225) 202 104 95, e-mail: biodiv@africaonline.co.ci

Barcelona Convention

- Title: Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean – adopted in 1976; in force since 1978; amended in 1995; amendments not in force yet
- Parties (21): **Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Morocco, Slovenia. Spain, Syria, Tunisia, Turkey** and the **European Union**[81]
- Depositary: Spain
- Geographic coverage: The maritime waters of the Mediterranean Sea proper, including its gulfs and seas, bounded to the west by the meridian passing through Cape Spartel lighthouse, at the entrance of the Straits of Gibraltar, and to the east by the southern limits of the Straits of the Dardanelles between Mehmetcik and Kumkale lighthouses. Except as may be provided in any protocol, the coverage does not include internal waters, wetlands, estuaries, seabed and its subsoil.
- Associated protocols: (1) Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea; (2) Protocol concerning Cooperation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency; (3) Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities; (4) Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean; (5) Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil; (6) Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal
- Associated Action Plan: (i) Action Plan adopted in 1975; in 1995 revised as Action Plan for the Protection of the Marine Environment and the Sustainable Development of the Coastal Areas of the Mediterranean (MAP Phase II), it includes the Barcelona Resolution and the Priority Fields of Activities for the period to the year 2005. (ii) Strategic Action Programme to Address Pollution from Land-Based Activities – adopted in 1997. (iii) Strategic Action Plan for the Conservation of Biological Diversity – being developed.
- Secretariat: Coordinating Unit for the Mediterranean Action Plan (MEDU), UNEP, P.O.Box 18019, GR 11610 Athens, Greece, tel (301) 7273 100, fax (301) 7253 196/197, e-mail: unepmedu@unepmap.org, website: www.medu.unep.org

[79] All eligible parties are listed. Parties that ratified or acceded to the Convention are indicated in bold.

[80] South Africa has expressed interest to accede the Convention.

[81] Yugoslavia is eligible to become a Party to the Convention, if it applies.

Bucharest Convention

- Title: Convention on the Protection of the Black Sea Against Pollution – adopted in 1992; in force since 1994
- Parties (6) **Bulgaria, Georgia, Romania, Russian Federation, Turkey** and **Ukraine**
- Depositary: Romania
- Geographic coverage: The territorial sea and exclusive economic zone in the Black Sea proper of each Contracting Party, with the southern limit constituted for the purposes of the Convention by the line joining Capes Kelagra and Dalyan.
- Associated protocols: (1) Protocol on Protection of the Black Sea Marine Environment against Pollution from Land-Based Sources; (2) Protocol on Cooperation in Combating Pollution of the Black Sea Marine Environment by Oil and Other Harmful Substances in Emergency Situations; (3) Protocol on the Protection of the Black Sea Marine Environment against Pollution by Dumping
- Associated Action Plan: Black Sea Environmental Programme (BSEP) – adopted in 1993; Black Sea Strategic Action Plan – adopted in 1996
- Secretariat: (1) for the Convention[82]; (2) for the BSEP: Programme Implementation Unit (PIU), Black Sea Environmental Programme, Dolmabahce Sarayi, II. Harekat Köskü, 80680 Besiktas, Istanbul, Turkey, tel (90 212) 227 99 27/9, fax (90 212) 227 99 33, e-mail: semaacar@blacksea-environment.org

Cartagena Convention

- Title: Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region – adopted in 1983; in force since 1986
- Parties (28): **Antigua and Barbuda,** Bahamas**, Barbados, Belize, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic,** European Union, **France, Grenada, Guatemala,** Guyana, Haiti, Honduras, **Jamaica, Mexico, Netherlands,** Nicaragua, **Panama,** St. Kitts and Nevis, **St. Lucia, St. Vincent and Grenadines,** Suriname, **Trinidad and Tobago, United Kingdom, United States of America** and **Venezuela**
- Depositary: Colombia
- Geographic coverage: The marine environment of the Gulf of Mexico, the Caribbean Sea and the areas of the Atlantic Ocean adjacent thereto, south of 30° north latitude and within 200 nautical miles of the Atlantic coasts of the Contracting Parties. The coverage does not include internal waters of the Contracting Parties.
- Associated protocols: (1) Protocol concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region; (2) Protocol concerning Specially Protected Areas and Wildlife; (3) Protocol concerning Pollution from Land-Based Sources and Activities
- Associated Action Plan: Action Plan for the Caribbean Environment Programme (CEP) – adopted in 1981 and periodically revised
- Secretariat: Regional Coordinating Unit for the Caribbean Environment Programme (CAR/RCU), UNEP, 14-20 Port Royal Street, Kingston, Jamaica, tel (1 876) 922 92 67/8/9, fax (1 876) 922 92 92, e-mail: uneprcuja@cwjamaica.com; website: www.cep.unep.org

Helsinki Convention

- Title: Convention on the Protection of the Marine Environment of the Baltic Sea Area – adopted in1974; in force since 1980; replaced by new convention adopted in 1992; in force since 2000
- Parties (10): **Denmark, Estonia, European Union, Finland, Germany, Latvia, Lithuania, Poland, Russian Federation** and **Sweden**
- Depositary: Finland
- Geographic coverage: The Baltic Sea and the entrances to the Baltic Sea bounded by the parallel of the Skaw in the Skagerrak at 57° 44.43'N, including the internal waters.
- Associated annexes: (1) Harmful substances; (2) Criteria for the use of Best Environmental Practices and Best Available Technology; (3) Criteria and measures concerning the prevention of pollution from land-based sources; (4) Prevention of pollution from ships; (5) Exemptions from the general prohibition of dumping of waste and other matter in the Baltic Sea Area; (6) Prevention of pollution from offshore activities; (7) Response to pollution incidents
- Associated Action Plan: Joint Comprehensive Environmental Action Programme (JCP) consisting of six elements – adopted in 1992
- Secretariat: Helsinki Commission, Katajanokanlaituri 6 B, FIN-00160 Helsinki, Finland, tel: (358 9) 6220 220, fax (358 9) 6220 2239, e-mail: helcom@mail.helcom.fi, website: www.helcom.fi

[82] The Convention Secretariat (Secretariat of the Black Sea Commission) was established in mid-September 2000; it is expected to be operational in mid-October 2000. The PIU will become an autonomous dependent unit of the Convention Secretariat.

Jeddah Convention

- Title: Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment – adopted in 1982; in force since 1985
- Parties (8): **Egypt,** Eritrea, **Jordan, Palestine (PLO), Saudi Arabia, Somalia, Sudan** and **Yemen**
- Depositary: Saudi Arabia
- Geographic coverage: The entire sea area bounded by the following rhumb lines: from Ras Dharbat Ali (lat. 16°39' N, long. 53°03,5' E), thence to a point (lat. 12°40' N, long. 55°00' E) lying ENE of Socotra Island, thence to Ras Hafun (lat. 10°26' N, long. 51°25' E). The coverage does not include internal waters of the Contracting Parties.
- Associated protocols: (1) Protocol concerning Regional Cooperation in Combating Pollution by Oil and other Harmful Substances in Cases of Emergency
- Associated Action Plan: Action Plan for the Conservation of the Marine Environment and Coastal Areas of the Red Sea and Gulf of Aden – adopted in 1976; revised in 1995
- Secretariat: Red Sea and Gulf of Aden Environment Programme (PERSGA), P.O.Box 1358, Jeddah, 21431, Saudi Araba, tel (966 2) 651 4472, fax (966 2) 657 0945, e-mail: persga@computec.com.bh

Kuwait Convention

- Title: Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution – adopted in 1978; in force since 1979
- Parties (8): **Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia** and **United Arab Emirates**
- Depositary: Kuwait
- Geographic coverage: Sea area bounded in the south by the following rhumb lines: from Ras Dharbat Ali in (16 deg 39 min N, 35 deg 3 min 30 sec E) then to a position in (16 deg 00 min N, 53 deg 25 min E) then to a position in (17 deg 00 min N, 56 deg 30 min E) then to a position in (20 deg 30 min N, 60 deg 00 min E) then to Ras Al-Fasteh in (25 deg 04 min N, 61 deg 25 min E) excluding the internal waters of the contracting parties.
- Associated protocols: (1) Protocol concerning Regional Cooperation in Combating Pollution by Oil and other Harmful Substances in Cases of Emergency; (3) Protocol concerning Marine Pollution resulting from Exploration of the Continental Shelf; (4) Protocol for the Protection of the Marine Environment against Pollution from Land Based Sources; (5) Protocol on Biological Diversity and Establishment of Specially Protected Areas (under development)
- Associated Action Plan: Action Plan for the Protection of the Marine Environment and the Coastal Areas of Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates – adopted in 1978 and periodically revised
- Secretariat: Regional Organisation for the Protection of the Marine Environment (ROPME), P.O.Box 26388, 13124 Safat, Kuwait, tel (965) 531 21 40-3, fax (965) 532 41 72, e-mail: ropme@kuwait.net

Lima Convention

- Title: Convention for the Protection of the Marine Environment and Coastal Areas of the South-East Pacific – adopted in 1981; in force since 1986
- Parties (4): **Chile, Colombia, Ecuador** and **Peru**[83]
- Depositary: Permanent Commission of the South Pacific
- Geographic coverage: The sea area and the coastal zone of the South-East Pacific within the 200-mile maritime area of sovereignty and jurisdiction of the High Contracting Parties and, beyond that area, the high seas up to a distance within which pollution of the high seas may affect that area.
- Associated protocols: (1) Agreement and Supplementary Protocol to the Agreement on Regional Co-operation in Combating Pollution of the South-East Pacific by Hydrocarbons or Other Harmful Substances in Case of Emergency; (2) Protocol for the Protection of the South-East Pacific against Pollution from Land-Based Sources; (3) Protocol for the Conservation and Management of Protected Marine and Coastal Areas; (4) Protocol for the Protection Against Radioactive Contamination
- Associated Action Plan: Action Plan for the Protection of the Marine Environment and Coastal Areas of the South East Pacific – adopted in 1981
- Secretariat: Permanent Commission of the South Pacific (CPPS), Regional Coordinating Unit of the Plan of Action of the South East Pacific, Coruna 2061 y Whimper, Quito, Ecuador, fax (593 2) 562 786, e-mail: cpps@ecuanex.net.ec

[83] Panama supports and participates in the Action Plan.

Nairobi Convention

- Title: Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region – adopted in 1985; in force since 1996; revision being considered
- Parties (9): **Comoros, France, Kenya,** Madagascar, Mauritius, Mozambique, **Seychelles, Somalia,** and **Tanzania**[84]
- Depositary: Kenya
- Geographic coverage: The marine and coastal environment of that part of the Indian Ocean situated within the Eastern African region and falling within the jurisdiction of the Contracting Parties to this Convention. The extent of the coastal environment to be included …. shall be indicated in each protocol to this Convention. Except as may be otherwise provided in any protocol, internal waters are excluded from the coverage.
- Associated protocols: (1) Protocol concerning Protected Areas and Wild Fauna and Flora in the Eastern African Region; (2) Protocol concerning Co-operation in Combating Marine Pollution in Cases of Emergency in the Eastern African Region
- Associated Action Plan: Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region – adopted in 1985
- Secretariat: Regional Coordinating Unit of the Eastern African Region/Seychelles, UNEP Secretariat of the nairobi Convention and related Action Plan, POBox 487, Mahe Seychelles, tel (248) 32 45 25, fax (248) 32 45 73, e-mail: uneprcu@seychelles.net

Noumea Convention

- Title: Convention for the Protection of Natural Resources and Environment of the South Pacific Region – adopted in 1986; in force since 1990
- Parties (19): **Australia, Cook Islands, Federated States of Micronesia, Fiji, France,** Kiribati, **Marshall Islands, Nauru, New Zealand,** Niue, Palau, **Papua New Guinea, Samoa, Solomon Islands,** Tonga, Tuvalu, United Kingdom, **United States of America** and Vanuatu
- Depositary: South Pacific Commission
- Geographic coverage: The 200 nautical mile zone established in accordance with international law of the Contracting Parties in the South Pacific region and those areas of the high seas which are enclosed from all sides by these 200 mile zones. Except as may be otherwise provided in any protocol to the Convention, internal waters and archipelagic waters of the Parties are excluded from the coverage.
- Associated protocols: (1) Protocol for the Prevention of Pollution of the South Pacific Region by Dumping; (2) Protocol concerning Cooperation in Combating Pollution Emergencies in the South Pacific Region
- Associated Action Plan: Action Plan for Managing the Natural Resources and Environment of the South Pacific Region – South Pacific Regional Environment Programme (SPREP) – adopted in 1982. The Action plan is revised every 4 year. The revision adopted in 2000 defines four main programme areas: nature conservation, pollution prevention, climate change and variability, and economic development.
- Secretariat: South Pacific Regional Environment Programme (SPREP), P.O.Box 240, Apia, Samoa, tel (685) 21 929, fax (685) 202 31, e-mail: sprep@samoa.net, website: www.sprep.org.ws
- SPREP is also the secretariat of two additional regional environmental conventions: (i) Convention on Conservation of Nature in the South Pacific Region (Apia Convention, adopted in 1976, entered into force in 1990); and (ii) Convention to Ban the Importation in Forum Island Countries of Hazardous Wastes and Radioactive Wastes within the South Pacific (Waigani Convention, adopted in 1995, not in force).

OSPAR Convention

- Title: Convention for the Protection of the Marine Environment of the North-East Atlantic – adopted in 1992; in force since 1998 (supersedes Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft – in force since 1974; and Paris Convention for the Prevention of Marine Pollution from Land-Bases Sources – in force since 1978)
- Parties (16): **Belgium, Denmark, European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland** and **United Kingdom**
- Depositary: France

[84] South Africa was invited to join the Convention.

- Geographic coverage: The internal waters and territorial seas of the Contracting Parties, the sea beyond and adjacent to the territorial sea under the jurisdiction of the coastal state to the extent recognised by international law, and the high seas, including the bed of all those waters and its subsoil, situated within the following limits: (i) that part of the Atlantic Ocean north of 59° north latitude and between 44° west longitude; (ii) those parts of the Atlantic and Arctic Oceans and their dependent seas which lie north of 36° north latitude and between 42° west longitude and 51° east longitude, but excluding (a) the Baltic Sea and the Belts lying to the south and east of lines drawn from Hasenore Head to Gniben Point, from Korshage to Spodsbjerg and from Gilbjerg Head to Kullen, and (b) the Mediterranean Sea and its dependent seas as far as the point of intersection of the parallel of 36° north latitude and the meridian of 5°36' west longitude.
- Associated annexes: Five annexes. Annex V on the Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area and a related Appendix – adopted in 1998, will enter info force as soon as ratified by at least seven contracting parties
- Associated Action Plan: OSPAR Action Plan 1998-2003 and long-term strategies related to (1) hazardous substances; (2) radioactive substances; (3) combating eutrophication; (4) protecting and conserving ecosystems and biological diversity; (5) environmental goals andmanagement mechanisms for offshore activities
- Secretariat: OSPAR Commission, 48 Carey Street, WC2A 2jQ, London, United Kingdom, tel (44 207) 430 5200, fax (44 207) 430 5225, e-mail: secretariat@ospar.org; website: www.OSPAR.org

B. PROGRAMMES AND ACTION PLANS WITHOUT CONVENTIONS

Action Plan for the Arctic Region

- Regional Programme of Action for the Protection of the Arctic Marine Environment from Land-based Activities (RPA) – adopted in 1998 (by the Ministers of the Arctic Council)
- Participating countries (8): Canada, Denmark, Finland, Iceland, Norway, Russian Federation, Sweden and United States of America
- Secretariat: PAME (Protection of the Arctic Marine Environment) International Secretariat, Hafnastraeti 97, 600 Akureyri, Iceland, tel (354) 461 1355, fax (354) 462 3390, e-mail: pame@ni.is, website: www.grida.no/pame/

Action Plan for the East Asian Seas

- Action Plan for the Protection and Development of the Marine and Coastal Areas of the East Asian Region – adopted in 1981
- Participating countries (10): Australia, Cambodia, China, Indonesia, Malaysia, Philippines, Republic of Korea, Singapore, Thailand and Vietnam
- Secretariat: Regional Coordinating Unit for the East Asian Seas Action Plan, UNEP, 10th floor, United Nations Building, Rajdamnern Avenue, Bangkok 10200, Thailand, tel (66 2) 281 24 28, fax (66 2) 267 80 08, e-mail: kirkman.unescap@un.org, website: www.unep.org/unep/regoffs/roap/easrcu/index.htm

Action Plan for the North-West Pacific

- Adopted in 1994
- Participating countries (4): China, Japan, Republic of Korea and the Russian Federation
- Contact: Division of Environmental Conventions, UNEP, P.O.Box 30552, Nairobi, Kenya, tel (254 2) 62 242 4011, fax (254 2) 622 4300, e-mail: jorge.illueca@unep.org

Action Plan for the South Asian Seas

- Adopted in 1995
- Participating countries (5): Bangladesh, India, Maldives, Pakistan and Sri Lanka
- Secretariat: South Asian Cooperative Environmental Programme (SACEP), No. 10 Dickman's Road, Off Dickman's Road, Colombo 5, Sri Lanka, tel (941) 589 787, fax (941) 589 369, e-mail: sacep@eureka.lk

C. EVOLVING CONVENTIONS, PROGRAMMES AND ACTION PLANS

Convention and Action Plan for the Caspian Sea

- Title (provisional): Framework Convention for the Protection of the [Marine] [Environment] of the Caspian Sea
- Parties (5): Azerbaijan, Iran, Kazakhstan. Russian Federation and Turkmenistan
- Associated programme: Caspian Environment Programme (CEP)[85]
- Contact for the Convention: Regional Office for Europe, UNEP, Case postale 356,15 Ch des Anemones, 1219 Chatelaine, Geneva, Switzerland, tel (41 22) 979 91 11, fax (41 22) 797 34 20, e-mail: unep@unep.ch
- Coordination of the convention's development: Regional Office for Europe, 15 ch Anemones, 1219 Chatelaine Geneve, Switzerland, tel: (41 22) 917 8111, fax (41 22) 917 8024, e-mail: frits.schligemann@unep.ch; Secretariat of CEP: Programme Coordination Unit, Government Building, U. Hadjibeyov 40, Baku 370016, Azerbaijan, tel/fax (99412) 971 785/86, e-mail: caspian@caspian.in-baku.com, website: www.caspianenvironment.org

Convention and Action Plan for the North-East Pacific

- Title (provisional): Draft Convention for the Protection and Sustainable Development of the Marine and Coastal Areas of the Northeast pacific – draft Convention being negotiated; adoption foreseen during 2001
- Participating countries: Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico Nicaragua and Panama; the participation of Canada and the United States of America a possibility
- Geographic coverage: coastal waters under the national jurisdiction of participating countries
- Associated Action Plan: Draft Plan of Action for the Protection and sustainable Management of the Marine and Coastal Environment of the Northeast Pacific Regional Sea – adoption foreseen in conjunction with the adoption of the Convention
- Contact: Division of Environmental Conventions, UNEP, P.O.Box 30552, Nairobi, Kenya, tel (254 2) 62 242 4011, fax (254 2) 622 4300, e-mail: jorge.illueca@unep.org

Cooperation Programme for the Upper South-West Atlantic

- Under development, currently focusing on the implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-Based Sources and Activities
- Participating countries: Argentina, Brazil and Uruguay
- Contact: Division of Environmental Conventions, UNEP, P.O.Box 30552, Nairobi, Kenya, tel (254 2) 62 242 4011, fax (254 2) 622 4300, e-mail: jorge.illueca@unep.org

[85] An ongoing programme supported by the GEF and the European Union (TACIS). The relationship between the Convention and the CEP will be depend on the decisions about the institutional arrangements expected to be taken at the adoption of the Convention.

ANNEX 4. REFERENCE POINTS FOR OCEAN MANAGEMENT AREAS (OMAS)

Objectives	Indicator	Reference Points
Maintenance of ecosystem diversity	• Areas of the continental shelf disturbed by fishing activities	• Percentage of each habitat type that is undisturbed
Maintenance of species diversity	• Number of individuals of the species at risk • Geographic area of distribution	• Maximum by-catch annually • Percentage of distributional area relative to period of moderate abundance
Maintenance of genetic variability within species	• Number of spawning populations of targeted species • Selection of differentials	• Percentage reduction in spawning areas • Minimum selection differential
Maintenance of directly impacted species	• Fishing mortality • Spawning stock biomass • Area of distribution	• $F_{0.1}$ • Minimum stock biomass necessary for recruitment and forage • Percentage of distribution relative to period of moderate abundance
Maintenance of ecologically dependent species	• Abundance of key predator • Condition of key predator • Percentage of prey species in diet of predator	• Minimum abundance level of predator • Minimum condition level of predator • Minimum percentage in diet of predator
Maintenance of ecosystem structure and function	• Slope of size spectrum • k-dominance curves • Pauly's FIB index • Aggregate annual removals by fishing for each trophic level	• Percent change in slope of size spectrum • Maximum “humpiness" change in k-dominance curve • Minimum level for index • Maximum percentage removal from a trophic level

ANNEX 5. ACTIVITIES OF REGIONAL SEAS CONVENTIONS AND PROGRAMMES RELEVANT TO FISHERY RESOURCES

Following are examples of past, ongoing or planned activities of Regional Seas Conventions and programmes that are directly or indirectly relevant to the management of fishery resources.

Abidjan Convention

The biennial work programme adopted in March 2000 by the Parties to the Convention includes a section on "*management of fisheries, mangroves and associated ecosystems".* The envisaged fisheries-related activities include: "*(i) reviewing the status and effectiveness of management structures for fisheries, mangroves and associated ecosystems; (ii) implementing effective management structures where non-existent; (iii) monitoring and surveying of organic and inorganic pollutants and their effects on fisheries; and (iv) building capacities and raising public awareness on the impact of mangrove deforestation on the fish spawning grounds, on the fauna and the loss of the productivity."*

In 1991, an assessment of critical habitats for fish, marine mammals and wildlife, particularly in estuaries, deltas, mangroves, wetlands, coral reefs and sea-grass beds was carried out by IUCN and IOC and the conservation requirements were identified. In 1992, a report was prepared for UNEP by IUCN was issued on "Identification, Establishment and Management of Specially Protected Areas and Regional Conservation Priorities", including country reports from eleven west and central African countries.

In the framework of the Marine Mammals Action Plan, IUCN coordinated the conduct of a study on the biology, ecology and behaviour of the West African manatee and organised a training course on the conservation of marine mammals (1992).

Barcelona Convention

The revised action plan (MAP Phase II) identifies, as the first of its five objectives: *"to ensure sustainable management of natural marine and land resources and to integrate the environment in social and economic development, and land-use policies".* Section 1.3.3 of the revised action plan on living marine resources recognises that *"several fish stocks are under heavy pressure"* and calls for *"immediate action at several levels (fishing communities, fisheries organisation, government) starting by reinforcing those already existing."* The same section of the plan identifies the among the main envisaged activities: *"improving the available information base on the status of living marine resources and encouraging research on the effects of environmental degradation and the impact on fishing activity"; "developing common resource management policies";* and *"establishing through the GFCM the legal framework for cooperative approach to the protection and conservation of living marine resources outside territorial waters".*

As priorities in the field of marine living resources in the period 1996-2005, Annex II of the action plan lists: "*(i) to develop common resource management policies inspired by the precautionary principle"*; and *"(ii) to implement conventions concerning fisheries especially the code of conduct for responsible fishing".*

The revised Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (1995) explicitly opens the possibility to regulate or to prohibit fishing in areas considered under the Protocol as specially protected.

The Strategic Action Plan for the Conservation of Biological Diversity in the Mediterranean envisages to address, among other issues, the interaction between fishing activities and biological diversity conservation. As outputs of this activity the following are expected: (i) an analytical study of fishing practices and gear used in the Mediterranean region; (ii) an analytical study on the legal measures provided by national regulations of the Mediterranean countries to minimise the impact of fishing activities on marine ecosystems and threatened and/or non-target species; (iii) guidelines for the elaboration of national action plans for the control of fishing practices and gear harmful to threatened species and habitats, and for the reduction of ecosystem alteration resulting from fishing pressure; and (iv) a draft Mediterranean Strategy to reduce the impact of fishing activities on sensitive habitats and ecosystems.

The Mediterranean Action Plan has an observer status with the GFCM.
Through a GEF-supported project a strategic action plan will be prepared in 2001 jointly with FAO to address the problems of biodiversity and the effects of fisheries on marine biodiversity.

Bucharest Convention

Article XIII of the Convention (Protection of the marine living resources) reads: "*The Contracting Parties, when taking measures in accordance with his Convention …., shall pay particular attention to avoiding harm to marine life and living resources, in particular by changing their habitats and creating hindrance to fishing and other legitimate uses of the Black Sea, and in this respect shall give due regard to the*

recommendations of competent international organisations." The practical steps for the implementation of the Conventions are defined by a ministerial declaration (the "Odessa Declaration") adopted by the ministers responsible for the protection of the Black Sea environment and are implemented through a regional action plan (the Strategic Action Plan – SAP) adopted in 1996. The SAP recognises that biological diversity and fisheries concerns should be part of the future agenda of the Commission established under the Convention.

A new protocol to the Convention is being prepared for the protection of landscape and biological diversity. The protocol will also embrace habitat protection related to fisheries.

Within the framework of the Black Sea Environment Programme (BSEP) – implemented with financial support of GEF/UNDP, the European Union (TACIS and PHARE) and other donor countries – three studies have been completed: a study on the status of fishery resources (it revealed that overfishing reduced the diversity of the Black Sea commercial species from 26 to 6 in less than 2 decades); a study on the development and functioning of the fishing fleet in the Black Sea; and a study on its aquaculture potentials. Maps related to fisheries and based on GIS were published on CD-ROM in 1997, and a project for assessment of fish stock is planned. "Fisheries" is one of BSEP's focal areas and in this context a "Regional Activity Centre for Fisheries" has been established in Constanta, Romania.

A report on "Invasion of a ctenophore Mnemiopsis leidyi in the Black Sea" has been prepared analysing the role of the invasion on declining fisheries. The report has been prepared by GESAMP as a contribution to the BSEP.

The Joint Danube-Black Sea Technical Working Group established under the GEF-supported projects in the Danube and Black Sea regions identified as long-term goal for all Black Sea countries: *"to take measures to reduce nutrient levels and other hazardous substances to such levels necessary to permit the Black Sea ecosystem to recover to similar conditions as those observed in the 1960s."*

A new GEF-supported project ("Black Sea Nutrient Reduction Programme") is being developed in support of BSEP. The project identifies "*a major decline in Black Sea commercial fish stocks and non-optimal harvesting of living resources"* as one of the "*transboundary issues requiring attention"* and the *"improved management of fisheries to permit their economic recovery in parallel with improvements to the ecosystem"* as one of the short term objectives of the project. The fishery-related activities of the project include: *(i) support to the completion of fisheries convention negotiations[86], particularly in relationship with the need to protect key habitats; (ii) evaluation of potential fisheries-free zones and marine protected areas, their promotion with Black Sea governments and stakeholders, their incorporation into the Landscape and Biodiversity Protocol to the Bucharest Convention and training of coastguards for their enforcement; and (iii) assessment of transboundary population of fish species and their relationship with current fishing practices."*

Cartagena Convention

The Caribbean Environment Programme (CEP), and particularly the Protocol concerning Specifically Protected Areas and Wildlife, have been instrumental to raise awareness about the importance of marine protected areas (MPAs) and their value for fisheries recovery and management in the region. A network of MPA managers has been established to facilitate the exchange of information and expertise and to promote, among others, the development of fishery reserves and zoning regulations. The region's capacity to manage MPAs has been considerably enhanced through a comprehensive training of trainers programme for MPA managers which addresses all aspects of MPA management, including zoning and applications to fisheries management. CEP's fisheries-related activities are coordinated with the relevant regional fisheries bodies and programmes (Caribbean Fisheries Resources Assessment Programme – CFRAMP; Caribbean Fisheries Council; Gulf and Caribbean Fisheries Institute – GCFI). In the framework of the cooperation with these bodies and programmes collaboration has been initiated on the development of management plans for economically important species such as the spiny lobster and the queen conch and on the promotion of fisheries reserves.

The implementation of the Protocol concerning Pollution from Lad-Based Sources and Activities will provide an opportunity to identify and classify highly sensitive and productive waters requiring special protection for their ecological and economic value.

Although CEP is not directly involved in the global project on Fisheries and Biodiversity Management funded by the European Union and implemented for the Africa-Caribbean-Pacific (ACP) regions by the Penang-based International Centre for Living Aquatic Resources Management (ICLARM), the implementation of the project is coordinated with CEP activities and CEP benefits from the exchange of data and reports generated by the project (e.g., "FishBase" data).

[86] It is not clear how will the new convention relate to the existing but apparently non-operational Convention concerning Fishing in the Black Sea (adopted in Varna, 7 July 1959).

The governments have asked the CEP Secretariat to assess spawning aggregations to determine priority conservation/reserves sites and promote best practices among fishers when impacting coral reefs. Subject to availability of funding, the assessment will be included in CEP's 2001-2003 workplan.

Caspian Convention

A proposal (dated June 1994) has been developed for a large scale ($ 35M) project that was expected to be supported by the GEF. The project ("Conservation of Biological Diversity of the Caspian Sea and its Coastal Zone") envisaged the development of a "Convention/agreement on Conservation and Utilisation of Bioresources of the Caspian Sea", the establishment of a "Commission" to guide and coordinate the implementation of the Convention, and a Secretariat to implement a large number of activities related to fishery management.

A considerably scaled down project was subsequently approved by the GEF and serves as the basis of the Caspian Environment Programme (CEP) that is supported and implemented jointly by GEF(UNDP) and the European Union (TACIS). In the framework of the CEP a Regional Strategic Action Programme (SAP) is being developed. Fisheries-related issues are among those that are planned to be treated in the framework of the SAP. The establishment of a Regional Thematic Centre for Sustainable Management of Fish Resources and other Commercially Exploited Aquatic Bioresources" was agreed. The Centre, to be established in Russia, would be expected to coordinate the implementation of fishery-related activities identified in the SAP.

Helsinki Convention

The Baltic prime ministerial level conference (Visby, May 1996) adopted the Presidency Declaration, followed by the Kalmar Communique by the foreign ministers (July 1996), that requested updating and strengthening HELCOM. The Action Programmes adopted at Kalmar requested, inter alia, "*the development of a coherent policy for sustainable fishing in the Baltic Sea based on a comprehensive plan to be elaborated by the International Baltic Sea Fishery Commission in consultation with HELCOM and ICES".*

The 1999 Extraordinary Meeting of HELCOM identified *"environmental impacts of fishery management and practices"* among the priorities within the framework of HELCOM

A Seminar, convened as part of the 22nd Meeting of the Helsinki Commission dealt, as one of three issues, with "Environment and Fishery – environmental impacts of fishing activities". An outcome from this session of the Seminar was a proposal for a joint HELCOM/IBSFC seminar on environmental impacts of fishing activities to be held during January 2002. Furthermore, it was decided to include relevant parts of the Global Environmental Facility (GEF) Baltic Sea Regional Project (BSRP) during the joint HELCOM/IBSFC seminar.

One of the objectives of the GEF BSRP is to increase sustainable biological productivity, i.e. fishery and to provide the three Baltic Sea international bodies, HELCOM, IBSFC and ICES, with management tools for sustainable coastal and marine management , while improving the social and economic benefits for fishing communities.

Jeddah Convention

The Convention recognises "*the need to develop management approach to the use of the marine and the coastal areas".*

Management of fisheries was among the issues addressed through the action plan associated with the Conventions. A report on the *Status of the Living Marine Resources in the Red Sea and Gulf of Aden Region and their Management* was prepared and issued in May 2000. The report is a comprehensive overview of the recent (1987-1998) status and development of fisheries in the region and their effect on the environment, including an overview of the current national legislation and the dominant socio-economic and cultural conditions in the fishing communities.

Kuwait Convention

The preambular paragraphs of the Convention recognise, *inter alia*, that pollution of the Convention area *"presents a growing threat to marine life, fisheries …"* and the region's *"special hydrographic and ecological characteristics … and its particular vulnerability to pollution",* as well as the need to prevent that industrial development *"jeopardise its living resources"* and *"to develop an integrated management approach to he use of the marine environment".*

At the 1998 Programme Consultation, the Secretariat reported that the status of fisheries in the region is recognised as an *"area of major importance"* and that *"a survey of the distribution of shrimp and fish populations in the Region is required as a baseline upon which management schemes can be developed".*

Nairobi Convention

The Eastern African Coastal and Marine Environment Resources Database and Atlas has been prepared as a georeferenced information base and planning tool. Inter alia, it extensively covers information on fisheries (e.g.: commercial, subsistence and big-game fisheries; marine farming; location and extent of fishing grounds; fishing methods and catch statistics), and fishery-related topics.

Noumea Convention

Through the Council of Regional Organisations of the Pacific (CROP), SPREP is involved in the preparation of a submission intended for presentation at the World Summit on Sustainable Development (South Africa, September 2002). The management and sustainability of inshore and oceanic fisheries is a major issue raised in the submission.

A Strategic Action Programme for the International Waters of the Pacific Small Island Developing States is implemented by SPREP, with assistance of UNDP and financial support of GEF. The objective of the Programme's oceanic component is *"to enable conservation and sustainable yield of ocean living resources"* through a coordinated programme of the South Pacific Commission (SPC) and the Forum Fisheries Agency (FFA). Within the framework of the coastal component of the Programme 3 pilot projects related to sustainable coastal fisheries are planned to be implemented.

SPREP's Coastal Management Programme contains a number of activities related to fisheries, such as: management of live reef fish trade; establishment of community-based fisheries reserves.

SPREP regularly participates, as an observer, in meeting organised by Regional Fishery Bodies (e.g., 48th meeting of Forum Fisheries Committee, Rarotonga, May 2001; 2nd Head of Fisheries Meeting, Noumea, July 2001).

Two formal fisheries-relevant agreements (Memoranda of Understanding) are signed between SPREP and SPC/FFA (for the implementation of the ocean component of the Pacific International Waters Programme) and UNEP (for the implementation of the Action Phase of the International Coral Reef Action Network).

OSPAR Convention

The preambular part of the Convention recognises that "*questions relating to the management of fisheries are appropriately regulated under international and regional agreements dealing specifically with such questions"*. Annex V of the Convention (article 4.1) specifies that *"no programme or measure concerning question relating to the management of fisheries shall be adopted under this Annex. However where the Commission considers that action is desirable in relation to such a question, it shall draw the question to the attention of the authority or international body competent for that question. Where action within the competence of the Commission is desirable to complement or support action by those authorities or bodies, the Commission shall endeavour to cooperate with them."*

In June 2000, the OSPAR Commission adopted the OSPAR Quality Status Report (QSR 2000). Section 6.1 of the Report analyses the impact of capture fisheries on the status of commercially exploited stock, by-catch, marine mammals, seabird populations and disturbance of seabed as well as the effectiveness of regulatory and technical measures applied in the OSPAR area. The concluding paragraph of the Section emphasises that *"It is generally recognised that fisheries management and environmental policies must be further integrated, within the framework of the ecosystem approach"* and identifies six specific priorities for action *"that could be considered by appropriate authorities".*

Regional programme for the Arctic

A Working Group for the Protection of the Arctic Marine Environment (PAME) has been established, in 1993, as one of the working group of the Arctic Council, as the lead in the implementation and further development of the Regional Programme of Action for the Protection of the Marine Environment from Land-based Activities (RPA).

PAME's main task is to address policy and non-emergency pollution prevention and control measures related to the protection of the marine environment from land based sources, and thus provide valuable information directly or indirectly relevant to the management of fishery resources. One of PAME's five objectives is to *develop and promote integrated and cost-effective actions* through which fishery-related activities are specifically promoted.

Regional programme for the North-West Pacific

The Action Plan adopted in 1994 for the North-West Pacific identifies fishery as a problems to be addressed. Towards this goal a project is being prepared for enhancing the ecosystem-based management of fisheries in the region.

ANNEX 6. INTERNATIONAL BALTIC SEA FISHERY COMMISSION DEFINITION OF SUSTAINABLE FISHERIES

Sustainable, productive fisheries are achieved when appropriate management ensures a high probability of stocks being able to replenish themselves over a long period of time within a sound ecosystem, while offering stable economic and social conditions for all those involved in the fishing activity.

Definition of Goals

Development of economically and socially sustainable, environmentally safe and responsible fisheries by

- maintaining biological viable fish stocks, the marine and aquatic environment and associated biodiversity;
- within these limits, establish maximum fishing possibilities and appropriate selective fishing techniques for harvesting stocks.

Distribute the direct and indirect benefits of open sea and coastal fishery resources between local communities in an equitable manner.

Indicators

The following indicators are intended to highlight the trends in biological systems, and the economies of the fishery dependent communities around the Baltic. The indicators will be provided by the coastal states.

Biological Indicators

- Spawning Stock Biomass (SSB): The part of the biomass of cod, herring and sprat, taking part in the reproduction process, in tonnes. This is an important indicator of the biological health of a given stock. Scientific information is only available for the most important commercial stocks in the Baltic Sea.
- Fishing mortality: the proportion of the average population removed annually by fishing.
- Recruitment: the number of fish reaching the age where they enter the fisheries.

Economic indicators

- Landings per country: total amount of landings in tonnes of cod, salmon, herring, sprat.
- Number of fishing vessels per country operating in the Baltic Sea.
- Average engine power per country: total Kilowatt of the fleet, divided by the number of vessels.
- Fish consumption per capita per country.

Social indicators

- Number of full time fishermen engaged in the Baltic Sea Region, per country.

ANNEX 7. INTERNATIONAL BALTIC SEA FISHERY COMMISSION ENDORSEMENT OF PRINCIPLES

The IBSFC welcomes and supports Chapter 17 of Agenda 21 of the Rio Declaration on Environment and Development. The IBSFC acknowledges the contributions from global and regional conventions and agreements and recognises the commitment to implement them for the Baltic.
The IBSFC acknowledges the contribution from other international instruments and guidelines, such as relevant conclusions of the Intermediate Ministerial Meeting, of the North Sea Conference 1997. In this context, the following guiding principles are pertinent:

- The sustainable development and long term sustainability of fisheries resources. In order to achieve this aim, conservation and management measures should be based on the best scientific evidence available, and should ensure that the needs of the present generation is met without compromising the ability of future generations to meet their own needs.
- Application of a precautionary approach to management of living marine resources, as set out in the FAO Code of Conduct for Responsible Fisheries. The absence of adequate scientific knowledge should not be used as a reason for postponing or failing to take conservation management measures.
- The equitable distribution of the direct and indirect benefit of the available fishery resources between various local communities dependent on open sea, coastal and inland fisheries.
- The minimisation of adverse impacts of fishing activities on species and habitats by taking appropriate measures in accordance with the above mentioned global conventions and agreements.
- Further integration of fisheries and environmental protection, conservation and management measures, drawing so far as scientific knowledge permits, on an **ecosystem approach** (emphasis added) encompassing the following:
  - the identification of processes in, and influences on, the ecosystems which are critical for maintaining their characteristic structure and functioning, productivity and biological diversity;
  - recognition of the interaction among the different components of food-webs of the ecosystems (multi-species approach) and other important ecosystem interactions; and
  - providing for an environment in these ecosystems which protects those critical ecosystem processes.

Reference texts relevant for the Fisheries Sector

I. International Conventions and Agreements

- United Nations Convention on the Law of the Sea (UNCLOS), signed at Montego Bay, Jamaica, on 10 December 1982.
- "Gdansk Convention", Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and in the Belts, signed at Gdansk, Poland, on 13 September 1973.
- The Convention on Biological Diversity, signed in Rio de Janeiro, June 1992.
- FAO Code of Conduct for Responsible Fisheries, 1995.

II. Political Declarations

- Rio Declaration on Environment and Development, UNCED, and „Agenda 21" which was jointly adopted in Rio de Janeiro, June 1992.
- The Declaration of Cancun on Responsible Fishing, 1992.
- Rome Consensus on World Fisheries, COFI 1995.
- Kyoto Declaration on Sustainable contribution of Fisheries to Food security, 1995.
- "Presidency Declaration" of Heads of State, Visby 3-4 May 1996.
- "Action programmes for the Baltic Sea States", Kalmar 2-3 July 1996.
- "An Agenda 21 for the Baltic Sea Region", Saltsjobaden, 20-21 October 1996.
- Conclusions from the Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues, Bergen, 1997.
- Declaration of the III Conference of Ministers of Fisheries, La Toja, 1997.

ANNEX 8. INTERNATIONAL BALTIC SEA FISHERY COMMISSION ECOSYSTEM CONSIDERATIONS

Interaction of pollution and fish stocks

As a brackish-water sea, the Baltic has an extremely low number of species compared with other sea areas , and a unique mix of marine, brackish-water and freshwater species. In the north of the Bothnian Bay salinity is very low and only a few marine species and a number of tolerant freshwater species are able to survive. The number of marine species decreases from the boarder with Kattegat along a gradient to the northernmost Baltic, while the number of freshwater species decreases in the opposite direction.

There are many gaps in our understanding of marine biodiversity and at present we do not know how many species given habitats support or whether there are species with a genetic make-up unique to specific sea areas. The principal threats to the biological diversity are eutrophication, toxic pollutants and the use of marine resources and waters through activities such as fishing, aquaculture, shipping, construction and extraction of mineral resources. The spread of non-native organisms and climate change could have serious consequences in the future. In order to facilitate future development of ecologically sound and productive marine ecosystems there is a need to study various biological interactions between species in specific reproduction and feeding areas.

The need to reduce pollution with negative impacts on fish stocks

There may be impacts on fish stocks resulting from the effects of contaminants on individual fish, particularly the effects of organic contaminants on the development of fish eggs and larvae. There is inadequate research on this topic and especially on how contaminant-related mortality of fish eggs and larvae, observed in experimental situations, may impact on populations of wild fish.

In addition, contaminants may play a role in the aetiology of the M-74 syndrome in Baltic salmon, resulting in mortality of fry. The role and type of contaminants is still under investigation, along with the mechanisms of their action.

Another type of impact relates to excessive nutrient inputs, which may cause increased phytoplankton primary production. Phytoplankton that are not consumed usually sink to near-bottom waters and ultimately the sea bed, where they decompose, using oxygen. In the Baltic Sea, in deep areas and in many areas under stratified or stagnant conditions, this may result in low oxygen concentrations or even anoxia, thus affecting benthic prey of demersal fish species (and occasionally the fish themselves). Low oxygen conditions that occur in water layers where cod eggs are buoyant affect the survival and development of these eggs.

Impact of eutrophication

Eutrophication caused by anthropogenic inputs of nutrients has had extensive effects on the Baltic marine ecosystem. Anoxia, caused by a combination of eutrophication and hydrographic/climatic conditions, occurs frequently in the western Baltic and in the deep waters of the central and northern Baltic, and has wiped out benthic communities over large areas of the seabed. In the case of cod, oxygen concentrations > 2 ml/l at the depths where eggs are neutrally buoyant are a necessary prerequisite for obtaining good recruitment, and anoxia in the bottom layer combined with low salinity at the spawning grounds reduces recruitment. The occurrence of oxygen in the bottom layer in the eastern and northern parts of the Baltic Sea is dependent on major inflows of oxygenated water from the North Sea.

Impact of pollutants

Toxic pollutants have had a great impact on animals at the tops of food webs, such as fish, seabirds and seals. Populations of seals crashed to extremely low levels due to combined effects of persistent organic pollutants and hunting. Effluents from pulp mills have harmed fish populations and altered patterns of genetic variation in mussel populations. Levels of toxic pollutants are now generally declining in marine biota, but levels are still high in sediments and Baltic seals still show signs of chronic disease. Changes in the food web and toxic pollutants probably contribute to the extensive mortality of salmon fry caused by the M74 syndrome in the Baltic Sea.

Impact of human activities on fish stocks

The utilisation of coastal and offshore waters for activities such as fishing, aquaculture, shipping, recreation, electric or engineering projects, dredging, dumping, extraction of gravel and sand, and oil prospecting has a large combined effect on the biodiversity of species and habitats. Shallow-water sites, which are of particular importance as spawning and nursery grounds, are at risk from a combination of factors such as coastal development, tourism and eutrophication. Some waters of the Baltic Sea are of international importance as overwintering areas for seabirds. Hydroelectric schemes built on rivers flowing into the Baltic have reduced the number of rivers in which salmon spawn from around 60 to approximately 30. The genetic diversity of wild salmon (which according to ICES now constitute less than 10% of total salmon populations) has been eroded by a combination of damming, M74 and fishing based on massive stockings of smolt from the more endurable hatchery reared populations.

About 30 non-native organisms have become established and most of the alien species are found close to shore but a few have become common in deep waters.

Global warming

Global warming due to the greenhouse effect could alter inputs of salt water, fresh water, oxygen, nutrients and pollutants with potentially large consequences for marine ecosystems and species. Change in currents would also influence the recruitment of organisms to coastal and offshore waters. Changes in the input of fresh water from rivers would have particularly large effects in the Bothnian Bay.

Impact of fisheries on the ecosyste; the need to protect species and habitats

Fisheries have both direct and indirect effect on the Baltic Sea ecosystem. Foremost are the direct effects caused by the removal of fish and shellfish for landing. Other direct effects include, inter alia, mortality on non-target fish and shellfish and other animals.

There is a threat to the biodiversity and a loss of habitats and biotopes in certain parts of the Baltic Sea area.

The protection of habitats and species in marine and coastal areas is essential for the functioning of the ecosystem of the Baltic Sea. The ecosystem should be used in a manner consistent with sustainable development, ensuring the conservation of biological diversity and the sustainable use of its components. This implies that adverse impacts of fishing activities on species and habitats in and around the Baltic Sea should be minimised by appropriate measures.

In areas where fishing methods and practices are not consistent with the principle of responsible and sustainable fisheries, these methods or practices should be restricted or prohibited by the competent authorities. Bottom-trawling affects the bottom habitat while gill nets are a potential threat to marine mammals and sea birds.

In cases where a disproportionately harmful ecological impact on species and habitats has occurred, appropriate measures for the restoration of biological diversity and habitats should be implemented. This includes, inter alia, the possible establishment of temporary or permanent closed areas.

A precautionary approach should be applied to all human activities involving non indigenous stocks, alien species and genetically modified organisms.

Further research should be encouraged in relation to:

- Interactions between fish and marine mammals (seals and cetaceans) and marine birds and the quantifications of by catches of fish, marine mammals and sea birds.
- Ecosystem effects of fishing (such as possible negative impacts of various fishing techniques).

ANNEX 9. SYNTHESIS OF RFB ACTIVITIES IN RELATION TO ECOSYSTEM-BASED FISHERIES MANAGEMENT

1. Impact of Fisheries on the Ecosystem

The impact of fisheries on the ecosystem is viewed from different perspectives by RFBs. Many link this to the protection of species and habitat, impact of gear and/or non-target, associated and dependent species (NADS) such as seabirds and marine mammals. The impact of aquaculture on the marine environment is also considered in this context.

On the whole, consideration of such impacts, especially those relating to gear and NADS, tends to focus on that part of the ecosystem relating to the fisheries resource.

CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources). CCAMLR adopts the view that an ecosystem approach does not concentrate solely on the species fished but also seeks to minimise the risk of fisheries adversely affected by "dependent and related species", and to regulate human activities (e.g. fishing) so that deleterious changes in the Antarctic ecosystems are avoided. It has tackled three substantial problems relating to mortality of marine animals caused directly or indirectly by the activities of humans, mainly (if not exclusively) relating to fishing. These are:

- incidental mortality of seabirds in fisheries, particularly longline fisheries;
- entanglement of marine mammals in marine debris; and
- impacts of fishing on the seabed.

CCAMLR has also embarked on an educational campaign aimed at fishermen to prevent pollution from marine debris, based on ecological and environmental reasons.

CCAMLR is very much involved in the work of the Committee of Environmental Protection of Antarctica, in the implementation of the agreement of the Antarctica Treaty contracting parties, and actively participates in the meetings as appropriate. CCAMLR web site contains a large amount of information with regard to CCAMLR's approach to ecosystem management.

CCSBT (Commission for the Conservation of Southern Bluefin Tuna). The Convention provides for the collection and exchange of data and other information relevant for scientific research on ecologically related species. In this regard the Commission has established an ecologically related species working group which has, among other things, developed guidelines for the design and use of tori lines, as devices for deterring sea birds from taking bait during the setting of lines for long line fishing operations.

Ecosystem management issues have been raised within the Commission, but firm strategies have not been developed to date; it is considered that the matter will need to be considered further in the context of the Commission's powers and responsibilities under the Convention.[87]

GFCM (General Fisheries Commission for the Mediterranean). The Scientific Advisory Committee supports studies on the impact of gear on non-target species and the marine ecosystem.[88]

IBSFC (International Baltic Sea Fishery Commission). In the ecosystem considerations to its Action Plan, IBSFC identifies a need to protect species and habitats from the impact of fisheries on the ecosystem. IBSFC has elaborated a programme of work jointly with other regional bodies dealing with the Baltic Sea marine environment. A Global Environmental Facility (GEF) project for the Baltic Sea region which might start this year for a five-year period has been designed. The project has two components: one marine-based component and one land-based component. The main objective of this project is to secure a healthy ecosystem and sustainable fisheries development. The activities of IBFSC with regard with ecosystem fisheries management, are elaborated in Annex 8.

IATTC (Inter-American Tropical Tuna Commission). Ecosystem modeling was being used to support the work the Commission was doing with issues related to by-catch. Mutual observer status had been established between IATTC and the Comisión Permanente del Pacífico Sur (CPPS) which permitted the

[87] Communication from Campbell McGregor, Executive Secretary, CCSBT.

[88] See Selected Global Issues in Fisheries of Relevance to GFCM, Twenty-fifth Session, Sliema, Malta, 12 – 15 September 2000.

exchange of information on data of mutual interest and the participation at meetings organised by either of the organisations. The Secretariats of both organisations had recently co-sponsored a technical meeting that examined climate change and its effect on fisheries in the Eastern Pacific Ocean. There was similar cooperation with PICES.

The IATTC Secretariat serves as the Secretariat for the Agreement on the International Dolphin Conservation Program (AIDCP). This agreement has among its principal objectives the management of the purse seine tuna fishery in the eastern Pacific Ocean in terms of its impact on the ecosystem as a whole. The AIDCP also requires that specific approaches regarding by-catch reduction, which is an important element of ecosystem management, be undertaken by the parties to the agreement.

ICES (International Council for the Exploration of the Sea). ICES continues[89] to contribute significantly to global knowledge about the impacts of fishing a global synthesis of fisheries impacts in different ecosystems, recently by convening the 1999 Symposium on the Ecosystem Effects of Fishing. ICES had developed research programmes on fisheries and ecosystems and a new advisory committee has been created to deal with overlapping issues between RSCs and RFBs.

IOTC (Indian Ocean Tuna Commission). Although its mandate is restricted to tuna and tuna-like species, has authorised collection of data on non-target, associated and dependent species (NTADs). Nevertheless, few data are available as logbook programmes of contracting and collaborating countries do not currently cover these species. Environmental anomalies are currently studied in relation to their effect on fish stocks. While there is no evidence of any cetacean mortalities in relation to purse seine fishing, predation of cetaceans on longline-caught fish is of increasing concern. Studies will also be conducted to establish whether FADs have acted as environmental traps for both target species and NTADs.

NASCO (North Atlantic Salmon Conservation Organization). NASCO has a mandate to consider ecologically related species, and action is being taken in relation to, *inter alia*, by-catch, introductions and transfers, habitat issues and the impact of aquaculture. It recently held a Special Session on habitat issues. Measures were also agreed to consider the effects of by-catch in other fisheries.

NASCO has adopted a detailed Action Plan which features the Precautionary Approach, and sees the latter as influencing the entire range of the salmon conservation and management activities of NASCO and its parties

NPAFC (North Pacific Anadromous Fish Commission). The Commission has over the years addressed ecosystem management in its work. One of the three main components of NPAFC Science Plan is salmonid habitat and ecosystem.[90] In the immediate past, the research activities included linkages between a composite Pacific Climate-Ocean Index and fluctuations in salmon and other fish populations, Ocean conditions and Pacific Salmon Stock Assessment in the North Pacific Ocean, Salmon Research cruises for stock assessment and carrying capacity estimation, oceanographic observations, sampling of sea surface water to estimate primary production, sampling of zooplankton, feeding habits, genetic stock identification, etc.

In its Work Plan for the year 2000, major activities include studies on coastal and offshore environmental characteristics of salmon habitat and ecosystem of the North Pacific, and salmon population dynamics. In addition to other information, the studies are expected to look into community structure and the role of salmon as prey for large predatory fish species and marine mammals.

PICES (North Pacific Marine Science Organization). PICES has established working groups to consider ecosystem aspects of fishing, such as WG 11 on the consumption of marine resources by marine birds and mammals.

NAMMCO (North Atlantic Marine Mammal Commission). NAMMCO has focused on ecosystem management approaches since the inception of the organisation. Currently, there is one active Working Group under NAMMCO Scientific Committee working with the complex problem of understanding marine mammal – fisheries interactions and the role of species in the ecosystem. The work of a previous Working Group resulted in the publication *Minke Whales, Harp and Hooded Seas: Major Predators in the North Atlantic* edited by Gisli A. Vikingsson and Finn O. Kapel, Volume 2 in NAMMCO Scientific Publications

[89] Note the Oslo Workshop on Ecosystem Management as a Basis for Conservation and Management of the North Sea (June 1998), the 1996, 1997 and 1998 Reports of the Working Group on Ecosystem Effects of Fishing Activities.

[90] The other two components are salmonid life history and salmonid population dynamics.

Series. The volume includes papers describing the diets of these species, provide estimates on the total consumption and discuss the potential predatory and competitive interactions of these species with important fish stocks. The studies are from various parts of the North Atlantic Ocean.

WECAFC (Western Atlantic Fishery Commission). The Cartagena Convention for the Wider Caribbean generally covers the same geographical area covered by WECAFC. This can facilitate cooperation between the Caribbean RSC and WECAFC and as such, initial contacts have been made to identify possible activities of common interest.

CECAF (Fishery Committee for the Eastern Central Atlantic). Excellent collaboration that exists between CECAF and the large marine ecosystem project for the Gulf of Guinea financed by GEF. This collaboration is expected to be strengthened as the CECAF Scientific Sub-Committee has recently established a working group to deal with environmental matters related to artisanal fisheries.

OLDEPESCA. All programmes and research activities of OLDEPESCA generally include components related to ecosystem-based fisheries management

2. The Impact of Other Sectors on Fisheries

Information relating to the impact of climate and ozone depletion is also relevant to this category.

IBSFC (International Baltic Sea Fishery Commission). The impact of human activities on fish stocks are a stated ecosystem consideration, as noted in Annex 8. Some stated concerns in this regard are: the utilisation of coastal and offshore waters for activities such as aquaculture, shipping, recreation, electric or engineering projects, dredging, dumping, extraction of gravel and sand, and oil prospecting, which have a large combined effect on the biodiversity of species and habitats.

IWC (International Whaling Commission). POLLUTION 2000+, a major research program developed by IWC, relates to the effects of chemical pollutants on cetaceans.

3. The Impact of Climate, Ozone Depletion on Fisheries

IBSFC (International Baltic Sea Fishery Commission). Climate change is an ecological consideration of IBSFC, as noted in Annex 8. In particular, global warming due to the greenhouse effect could alter inputs of salt water, fresh water, oxygen, nutrients and pollutants with potentially large consequences for marine ecosystems and species. Change in currents would also influence the recruitment of organisms to coastal and offshore waters. Changes in the input of fresh water from rivers would have particularly large effects in the Bothnian Bay.

IPHC (International Pacific Halibut Commission). has developed an assessment method and management strategy that are robust to environmentally driven changes in the Pacific halibut stock. Understanding the reasons for those changes is nonetheless of great scientific interest. Research is being conducted under the auspices of several national and international programs, including Global Ocean Ecosystem Dynamics (GLOBEC), the North Pacific Anadromous Fisheries Commission (NPAFC), and the North Pacific Marine Science Organization (PICES).[91] In this manner, a comparative research approach is being implemented, with studies across species, regions and time periods providing the replicate observations needed to test hypotheses.

IWC (International Whaling Commission). IWC has accorded priority to research on the effects of environmental changes on cetaceans. It has established a major research program, SOWER 2000, which relates to the effects of climate change and ozone depletion on cetaceans.

PICES (North Pacific Marine Science Organization). PICES has, among its purposes, to advance scientific knowledge about the ocean environment, global weather and climate change. Its regular reports about the state of the North Pacific and activities of its assorted working groups achieve this.

SPC's Oceanic Fisheries Program (South Pacific Community). SPC has established an ecosystem research program, and reports that considerable progress has been made in understanding the basic dynamics of the warm pool ecosystem, which relates climatic conditions, *inter alia*, to the distribution of fish.

[91] See http://www.iphc.washington.edu/halcom/research/environ/decadal/decadal/html.

4. Ecosystem Monitoring

The information provided in relation to climate change is also relevant to ecosystem monitoring.

CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources). The CCAMLR Ecosystem Monitoring Program (CEMP), described above, is a scientific program aimed at detecting changes in the condition, abundance and distribution of the animals within the Convention Area. The parameters being monitored fall into four categories: reproduction, growth and condition, feeding ecology and behaviour, and abundance and distribution. Information on predators, prey and the environment are collected simultaneously and submitted to the Working Group on Ecosystem Monitoring and Management for preparation of advice to the Scientific Committee.

IWC (International Whaling Commission). IWC pioneered the development of a feedback management procedure that incorporates a variety of ecosystem-related factors which explicitly take uncertainty into account.

PICES (North Pacific Marine Science Organization). PICES has among its purposes to advance scientific knowledge about the living resources and their ecosystems in relation to the North Pacific, and an example of its activity in this area is the working group it established on Subarctic Pacific Monitoring.

ANNEX 10. RECOMMENDATIONS OF THE THIRD GLOBAL MEETING OF THE REGIONAL SEAS CONVENTIONS (MONACO, 6-9 NOVEMBER 2000) RELEVANT TO THE PRESENT PAPER

119[92]. Recognising the potential benefits that could be derived from closer cooperation among the regional seas conventions and action plans and the regional fishery bodies in the fields relevant to ecosystem-based management of fisheries, the meeting endorsed the actions recommended for the enhancement of this cooperation to:

♦ formalise the observer status of the regional seas conventions and action plans at the meetings of the governing bodies of the regional fishery bodies and their technical subsidiary organs, and vice versa;

♦ exchange data and information available at the level of regional fishery bodies and the regional seas conventions and action plans that may be of mutual interest;

♦ organise joint technical meetings on subjects of mutual interest; and

♦ design and implement joint programmes between the regional fishery bodies and the regional seas conventions and action plans, taking fully into account the respective mandates, objectives and scope of the regional seas conventions and action plans and the regional fishery bodies.

120. On the understanding that the paper was intended to be presented to the forthcoming meeting of regional fishery bodies organised by the FAO in February 2001, the meeting also recommended that, before presenting the paper to that meeting, it should be amended taking into account the following comments and suggestions:

♦ information on the status and activities of regional seas conventions and action plans should be updated and expanded, whenever necessary;

♦ the role of the EU in shaping the fisheries management policy of its member states should be highlighted;

♦ the advantages and mutual benefits that would derive from the association of the Global Ocean Observing System (GOOS)[93] with the programmes carried out under the regional seas conventions and action plans and the regional fishery bodies should be recognised and elaborated;

♦ the enhanced cooperation among regional fishery bodies and regional seas conventions and action plans on issues relevant to ecosystem-based management of fisheries would be a considerable contribution towards the implementation of global conventions and programmes, such as the Convention on Biological Diversity and the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities.

[92] Paragraphs 119 and 120 refer to the report of the Monaco Meeting.

[93] See Annex 12.

ANNEX 11. EXCERPT FROM THE REPORT OF THE SECOND MEETING OF FAO AND NON-FAO REGIONAL FISHERY BODIES AND ARRANGEMENTS (ROME, 20-21 FEBRUARY 2001) RELEVANT TO THE PRESENT PAPER

65.[94] The Meeting agreed for the need for closer collaboration between regional fishery bodies and regional seas conventions.

[94] Paragraph 65 refers to the report of the Rome meeting.

ANNEX 12. DESIGN AND IMPLEMENTATION OF THE COASTAL MODULE OF THE GLOBAL OCEAN OBSERVING SYSTEM: RELATIONSHIPS WITH THE MARINE REGIONAL FISHERY BODIES AND REGIONAL SEAS CONVENTIONS

(prepared by Tom Malone and Colin Summerhayes)

Preamble

The Global Ocean Observing System, GOOS, is being developed by IOC (UNESCO), WMO, UNEP, FAO and ICSU to detect and predict changes in the state of marine and estuarine ecosystems (from sea state and currents to water quality, habitats, and living resources) and to improve predictions of global climate change and its effects on people and ecosystem goods and services. The principles upon which the GOOS is designed and the Strategic Plan for achieving its long term goals have been published by the IOC (http:www.ioc.unesco.org/goos): (i) Strategic Plans and Principles for the Global Ocean Observing System (GOOS Report 41) and (ii) The GOOS 1998 (GOOS Report 42).

As of October 2001, GOOS is being developed by the Ocean Observations Panel for Climate (OOPC) and the Coastal Ocean Observations Panel (COOP) in two related and convergent modules: (i) a basin scale module that is primarily concerned with the ocean-climate system (improved weather forecasts and long-term climate predictions, OOPC) and (ii) a coastal module that is primarily concerned with local manifestations of large scale changes occurring in the ocean basins, coastal drainage basins, and airsheds (improved detection and prediction of changes caused by anthropogenic and natural forcings, COOP).

Intergovernmental agreements that provide the legal basis for GOOS or stipulate national obligations for cooperation include (1) the 1982 UN Convention on the Law of the Sea, (2) the Second World Climate Conference in 1990, and (3) two conventions and a program of action signed at the 1992 UN Conference on Environment and Development (UNCED) in Rio de Janeiro (the Framework Convention on Climate Change, Convention on Biodiversity, and the Program of Action for Sustainable Development or *Agenda 21*). The Law of the Sea Convention provides the legal basis for implementing GOOS by defining jurisdictions in the form of territorial seas and the EEZ; the Climate Conference recommended establishing an observing system, including a global ocean observing system, to monitor climate variability and change more effectively; and *Agenda 21* calls for the establishment of a global ocean observing system that will enable effective and sustainable management and utilisation of the marine environment and its natural resources. Provision of the data and information required for ecosystem-based management of the environment and fisheries is a major part of this mandate.

The Initial Observing System of GOOS

GOOS will come into being by incorporating, enhancing and supplementing existing programmes and activities. Existing programmes include the following:

(1) fixed buoys (e.g., the TAO/TRITON buoy array in the equatorial Pacific, and the PIRATA array in the equatorial Atlantic);
(2) drifting buoys (deployed by the Data Buoy Cooperation Panel);
(3) ships (e.g., meteorological measurements from the WMO's Voluntary Observing Ship programme and disposable bathythermograph measurements from the IOC/WMO Ship of Opportunity Programme);
(4) tide gauges (in the IOC's GLOSS programme);
(5) times series stations (S off Bermuda and Bravo in Labrador Sea);
(6) satellites (measuring ocean topography, ocean vector winds, sea surface temperature, ocean colour, sea-ice, fronts and currents, and plumes);
(7) repeat water sampling surveys (ICES International Bottom Trawl Survey of the North Sea – physical and chemical data only);
(8) ocean plankton surveys (e.g., the Continuous Plankton Recorder programme);
(9) comprehensive plankton and ocean margin surveys (e.g., California Cooperative Fisheries Investigations)
(10) comprehensive biological monitoring of coral reefs (Global Coral Reef Monitoring Network).

Merging these programmes into the Initial Observing System began in 1998 and is ongoing as the GOOS design is refined by the OOPC and COOP.

The GOOS-IOS also includes pilot projects to enhance and supplement existing programmes. These include the Global Ocean Data Assimilation Experiment (GODAE) and Argo. GODAE is a proof of concept project that will integrate data from satellite remote sensing with data from in situ measurements to provide improve forecasts of regional and global weather patterns and long-term climate chanage. The Argo profiling float programme will enhance in situ observations by seeding the ocean with 3000 profiling floats between 1999 and 2005.

The Coastal Module of GOOS

The coastal module of GOOS is an effort to coordinate, enhance and supplement existing research and monitoring activities in marine and estuarine ecosystems to provide more timely detection and prediction of the effects of external forcings on

- the people who live in, work in and enjoy coastal environments,
- coastal estuarine and marine ecosystems, and
- the living marine resources they support.

The system is to be and end-to-end (measurements-data management-analysis) and user-driven. It is to develop by making more cost-effective use of existing infrastructure, expertise and knowledge; it is to be sustained in perpetuity and integrated (physical, biological and chemical measurements and data processing), and it is to provide rapid access to diverse data from disparate sources.

The terms of reference for COOP identify three themes to be addressed by the observing system: (1) coastal marine services, (2) ecosystem and public health, and (3) living marine resources. The phenomena of interest that are of primary concern are listed in Table 1. The phenomena are indicators of the status of marine and estuarine ecosystems that affect marine services, public safety, public health, ecosystem health and living marine resources. They represent a broad spectrum of environmental variability (hours - decades) that reflects the and nature of the external forcings that impinge on the coastal environment and the inherent characteristics of coastal ecosystems.

Most of the phenomena of interest are local in scale and are occurring in coastal ecosystems world-wide, a pattern that suggests they are, more often than not, local expressions of larger scale forcings that are of natural origin, anthropogenic origin, or both (Table 1). Examples of such forcings include global climate change and ENSO events; changes in inputs of water, sediments, nutrients and contaminants from coastal drainage basins and air-sheds (atmospheric equivalent to drainage basin or watershed); fishing; and global movements of ships, people and cargo.

The strategy for the design of the coastal module of GOOS is based on two basic concepts that are related to the structure and function of estuarine and marine ecosystems: (1) physical processes structure the pelagic environment and are of fundamental importance to most, if not all, of the phenomena of interest; and (2) the phenomena are not independent but related through a hierarchy of interactions that can be represented by robust models of ecosystem dynamics. This suggests that there is a relatively small set of common variables that, if measured with sufficient resolution over sufficiently long periods and large areas, will serve many needs from forecasting the effects of storms and harmful algal events on short time scales (hours to days) and predicting the effects of fishing on fish stocks and ecosystems on intermediate time scales (months-years) to predicting local manifestations of global climate change on longer time scales (years-decades).

Toward a Global Federation of Regional Observing Systems

It should be clear from the above that the continued development of Marine Regional Fishery Bodies and Regional Seas Conventions is critical to the successful design and implementation of coastal GOOS. The advantages and mutual benefits of collaboration fall into three important categories: (1) the requirements for managing the environment and living marine resources in an ecosystem context, (2) regional requirements for design and implementation, and (3) making more cost-effective use of existing infrastructure, expertise and knowledge.

Ecosystem-Based Management: The data requirements of coastal marine services are, for the most part, common to all three themes specified in the terms of reference. Safe and efficient coastal marine operations require accurate nowcasts and timely forecasts of storms, coastal flooding and precipitation; of coastal wind-, current-, wave-, and ice-fields; and of water depth, temperature and visibility. The set of variables that must be measured and assimilated in near real time include barometric pressure, winds, air and water temperature, sea level, stream flows, and surface currents and waves. In addition to these variables, protecting, sustaining and restoring coastal ecosystems require timely data on environmental variables needed to detect and predict changes in biological, chemical and geological phenomena, e.g., nutrient concentrations, attenuation of visible light, suspended sediments, biomass, species composition, concentrations of contaminants and pathogens. The demands of protecting living marine resources and managing harvests (of wild and farmed stocks) in an ecosystem context require data on all of the above as well as timely information on population (stock) abundance, distribution, age (size)-structure, fecundity, year-class strength, migratory patterns, and mortality rates (including catch statistics). These realities underscore the need for a more integrated, ecosystem-based approach to environmental protection and the management of living resources.

A Regional, More Cost-Effective Approach: Given the interdependence of the physical and ecological processes that govern the status of estuarine and marine ecosystems and the reality that priorities vary

regionally and among nations, **the coastal ocean observing system is conceived as a global network (the backbone) for the measurement of common variables that is regionally enhanced (e.g., more variables, greater resolution, additional products) to detect and predict state changes that are of greatest concern to participating countries**. This emphasises the importance of building the global system through the coordinated development of regional (multi-nation) observing systems. The GOOS design strategy also calls for the development of a more cost-effective approach to research, monitoring and management by building on existing programs and projects as justified by the information needs of user groups (including government agencies responsible for water quality and fisheries management and industries that are dependent on water quality and fish yields).

Regional Seas Conventions, Regional Fishery Bodies and GOOS: Clearly, the development of the coastal module will depend on regional approaches that make more cost-effective use of existing infrastructure, expertise and knowledge. These requirements can be most effectively met through the coordinated and integrated development of Regional Fishery Bodies, Regional Seas Conventions and GOOS.

The UNEP Governing Council of 2001 endorsed a Resolution calling for a closer relationship between UNEP's RSP and GOOS. The IOC Assembly, at its 21st session (July 2001) endorsed a similar recommendation calling for GOOS to work closely with UNEP at the regional level to assist in implementing the RSPs. Underpinning this cooperation is acceptance of the fact that GOOS will incorporate existing mechanisms, while providing the added dimension of a fully comprehensive and integrated approach.

Practical implementation of this collaboration has begun. In the Baltic, the Baltic Operational Oceanographic System (BOOS), which is following the design advice of COOP and the OOPC under the umbrella of EuroGOOS (the European Regional Association for GOOS, which formed in 1994) has developed an agreement with the Helsinki Commission to provide direct support to HELCOM requirements, including converting HELCOM data into advanced products. Similar developments are underway in the North Sea area, where EuroGOOS's Northwest Shelf Operational Oceanographic System (NOOS) is about to come on line. NOOS will have close connections to OSPAR. Additional examples include the following:

> In the Mediterranean, all the riparian states banded together in 1997 to form MedGOOS, an association of agencies for developing GOOS within the region. MedGOOS has been developed with the full support of the UNEP RSP Secretariat for the Mediterranean, in Athens, is now funded by the European Commission, and has a Secretariat in Malta. MedGOOS members will work together to improve local and regional scale physical and ecological monitoring and modeling in support of sustainable development. They will begin by building on existing systems. In concert with the UNEP Athens office, their work will lead to an improved context for the work of the Barcelona Convention. Good progress has already been made on physical and ecosystem modeling through the EC-funded Mediterranean Forecasting System Pilot Project.
>
> In the Caribbean the island and continental coastal states banded together in 1999 to form IOCARIBE-GOOS, an intergovernmental sub-group of the IOC's regional subcommission for the Caribbean (IOCARIBE) aimed at developing GOOS within the region. Plans are in hand to link IOCARIBE-GOOS, which is still in its infancy, with the UNEP RSP Secretariat for the Caribbean, in Kingston. A strategic plan is now being developed, along with an inventory of current activities.
>
> In the Pacific islands, PacificGOOS was begun in 1998 under the aegis of SOPAC and in association with the IOC. It has drafted its strategic plan and outlined a set of practical pilot projects including ones on monitoring coastal water quality, monitoring pearl culture and seaweed farming, and monitoring reef health. Its activities map onto and can support those of UNEP's SPREP (South Pacific Regional Environment Programme).
>
> The Black Sea countries have signed a Memorandum of Understanding (July 2001) to develop a Black Sea GOOS. This maps onto UNEP's Bucharest Convention.

ICES is also working closely with GOOS. In 1998 ICES formed an ICES Steering Committee on GOOS. Later, in 1999, this was transformed into an ICES-IOC Steering Committee on GOOS that includes representatives from the GOOS Project Office and EuroGOOS. ICES and EuroGOOS recently held a joint workshop on bio-ecological observations in oceanography (The Hague, April 2000)(EuroGOOS Publication 15, October 2000). In order to assist in the development of an ecosystem-based approach to fisheries management, ICES, EuroGOOS, IOC, and OSPAR are co-convening a workshop in Bergen (5-7 September 2001) entitled 'Towards a North Sea Ecosystem Component of GOOS for Assessment and Management'. This will take forward the recommendation from the Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues of the North Sea (March 1997) to: (a) agree a strategy for a coordinated and harmonised network in order to progress the development of an ecosystem approach to North Sea management, and (b) develop the strategy in order to increase the efficiency and cost effectiveness of current national and international monitoring systems through the implementation of a pilot North Sea Ecosystem GOOS project which will integrate fisheries and oceanographic data. The results will be presented to North Sea Ministers in March 2002.

PICES is also working closely with GOOS. It held a GOOS workshop as part of its annual meeting in Vladivostock in 2000. It is now co-convening, with IOC, a workshop on regional forecasting that will be held in August 2001, in Seoul, as part of the IOC WESTPAC annual scientific conference. PICES is considering the implications of setting up a Regional Analysis Centre (RAC) along GOOS lines for the North Pacific.

In conclusion, we see great potential for developing practical working relationship with RFBs in much the same way as functional linkages with the RSCs are being developed. GOOS not only provides a framework for enabling coordination and collaboration among RFBs and RSCs, the successful development of such cooperation is critical to the cost-effective implementation of the coastal module of GOOS.

Table 1. Natural and anthropogenic forcings and associated changes in the phenomena of interest in coastal marine ecosystems that are the subject of Coastal GOOS. No attempt has been made to distinguish between anthropogenic and natural forcings because, although some forcings are clearly of human origin (e.g., harvesting marine resources and chemical contamination), there are few if any "natural" forcings that do not have a human signature of some sort (e.g., climate change).

Natural & Anthropogenic	**FORCINGS** • **Global warming & sea level rise** • **Storms & other extreme weather events** • **Ocean currents , waves, tides & storm surges** • **River & ground water discharges** • **Physical restructuring of the environment** • **Construction of impervious surfaces & dams** • **Harvesting living & nonliving resources** • **Nutrient enrichment, Sediment inputs, Chemical contamination, & Inputs of human pathogens** • **Introductions of non-native species**
Marine Services & Public Safety	**PHENOMENA OF INTEREST** • **Changes in sea state & sea ice** • **Coastal circulation** • **Coastal flooding** • **Shoreline changes** • **Changes in shallow water bathymetry**
Public Health	• **Seafood contamination** • **Abundance of pathogens**
Status of Coastal Marine Ecosystems	• **Habitat modification & loss** • **Changes in biodiversity** • **Harmful algal events & invasive species** • **Water clarity & oxygen depletion**
Living Resources	• **Changes in the abundance & harvest of exploitable living marine resources** • **Disease & mass mortalities of marine organisms**

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