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**Marine science and the development and transfer of marine
technology, including capacity-building**

Submitted by the delegation of Norway

Summary

The present document has been prepared with the assistance of experts in marine science and is intended to analyse and identify possible plans of action to activate the new regime on marine scientific research established by Part XIII of the 1982 United Nations Convention on the Law of the Sea. There is a risk that the new marine science regime will remain an “empty shell” unless concrete policies and results-oriented initiatives are formulated and implemented. At the core of such results-oriented initiatives lies the implementation of national regulations relating to foreign marine scientific research in waters under national jurisdiction and the identification of national focal points to coordinate such research activities. In this document we propose a plan of action for the implementation of Part XIII and are using Norwegian model legislation as an example to this end. Compliance with article 76 and with article 4 of Annex II to the Convention represents a major challenge for coastal States, including in particular developing countries and small island developing States. We are suggesting a plan of action that will enable coastal States with limited resources of their own to acquire data on mapping of the outer limits of the continental shelf. While scientifically based regulatory management regimes are often well established and given considerable resources in the industrialized world, developing countries and regions often lack the human and financial resources to establish measurements on an effective scale. We are suggesting a plan of action for assisting a developing region to draw up a scientifically based integrated ocean management regime. The emphasis on an ecosystem approach to marine management has a number of implications for marine science. The final part of the document proposes a plan of action for a scientifically based ecosystem approach to the management and protection of marine ecosystems.



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A. Implementation of Part XIII of UNCLOS as a first step in a plan of action for marine scientific research

1. The entry into force of UNCLOS in 1994 brought into being a new regime for the conduct and promotion of marine scientific research. Under this regime all States and competent international organizations have the right to conduct marine scientific research and the duty to promote and facilitate, the development and conduct of such research.

2. There is a risk that the marine science regime, as defined in Part XIII of UNCLOS, will remain an “empty shell” unless concrete policies and results-oriented initiatives are formulated and implemented. At the core of such necessary and results-oriented initiatives lies the implementation of national regulations relating to foreign marine scientific research in waters under national jurisdiction and the identification of national focal points to coordinate such research activities. **The adoption of regulations on marine science research, based on a common understanding of those rules, will provide clarity and predictability for people involved in preparing and planning research projects, facilitate the introduction of standard procedures in accordance with international practice and ensure better flow of information through authorized organizations and channels to create acceptability of results. Thus the adoption of such regulations represents a first step in a plan of action for marine scientific research.**

3. **Norway recently adopted new regulations relating to foreign marine scientific research in Norway’s internal waters, territorial sea and economic zone and on the continental shelf, in accordance with Part XIII of the Convention. These regulations, which are contained in the annex to the present document, may serve as a model of the implementation of Part XIII at the national level. The standard application form incorporated in the Norwegian regulations (see appendix) is the standard form used by the International Council for the Exploration of the Sea (ICES).**

B. Marine scientific research and mapping of the outer limits of the continental shelf: a plan of action to enable coastal States with limited resources of their own to utilize data from marine research projects

4. For several decades the hydrography of the seabed and the geology of the subsurface of the deep oceans and outer edge of continental margins have been important targets of marine scientific research throughout the world. Two good examples of well-known research programmes in this field are the Deep-Sea Drilling Project (DSDP) and the follow-up Ocean Drilling Project (ODP), both of which involve world’s best academic and technical expertise in the field, and have been financed and organized as scientific consortia. Several major States with substantial resources and know-how are also undertaking their own major research and survey programmes in the same field. Consequently, a substantial volume of bathymetric and geophysical/geological data obtained from the continental margins are stored in scientific institutions and data centres around the world. Because of the vast areas in question and the large costs involved, data accumulation in these areas has been slow, and the data density is at present only a fraction of what is common in shallower areas with offshore petroleum exploitation. Therefore, despite the relatively long research history, our knowledge of the hydrography and geology of the deep oceans and the continental margins is unsatisfactory and research in this field still has a long way to go.

5. The provisions of article 76 define how the limits of the continental shelf beyond 200 nautical miles from the baselines are to be delineated. These provisions imply that the hydrography and geology of the outer parts of the continental margins of States intending to establish such limits must be mapped by certain methods. Article 76, paragraph 8, and Annex II, paragraph 4, require the States in question to submit the details of these limits to the Commission on the Limits of the Continental Shelf along with supportive scientific and technical data. The main volume of the requested supportive data will consist of the bathymetric and geophysical (mainly seismic) data used in the original mapping of the limits. Annex II, paragraph 4, also states that such States must submit all the required information and supportive data within 10

years after the Convention entered into force for the individual State. This means that in the next few years we need to speed up the acquisition of bathymetric and seismic data on the outer parts of the continental margins and the adjacent deep sea, so that all relevant States can comply with the provisions of article 76. This will mean a dramatic increase in available bathymetric and geophysical data from waters covering the transition zone between the deep oceans and the outer continental margins.

6. However, all the data that will be acquired for the purpose of mapping the limits of the continental shelf are of the same type as those collected by research institutions and organizations in their various studies of the continental margin and deep ocean. And similarly, all the bathymetric and geophysical data acquired on the outer edge of the continental margins and adjacent deep sea by the world's marine research institutions and organizations, are highly relevant for any State that intends to establish the outer limits of its continental shelf beyond 200 nautical miles.

7. It is obvious that a coastal State will benefit from access to all existing bathymetric and geophysical data from the relevant research databases, in order to prepare a submission. Articles 248 and 249 of the Convention give a State the right of access to all data acquired by any scientific institution within the continental shelf of that State. Article 249 also lays down the duty of the research institute or organization to provide the host State with reports and research results and to provide ready access to all data acquired from the continental shelf. According to article 246, any marine scientific research activity on the continental shelf shall be conducted only with the consent of the coastal State. Since the rights of a coastal State over the continental shelf in accordance with article 77 exist independently of the final delineation of the outer limits in accordance with article 76, any such State may apply articles 246, 248 and 249 to gain access to and be provided with the relevant scientific data to establish such delineation. This opportunity will be particularly important to coastal States that lack their own funds and expertise.

8. Furthermore, article 249 states that the research institution or organization has a duty to ensure that the research results from the continental shelf are made internationally available (duty to publish). This is of benefit both to the coastal State (making the shelf area

known to possible investors) and to the international research community.

9. A plan of action to enable coastal States with limited resources of their own to utilize data from marine research projects may include:

(a) An investigation of where and how many research data are already available and the extent of such data, and steps to gain access to these data according to article 249;

(b) Taking steps to encourage other States and international research organizations to undertake research projects on the continental shelf, particularly on the outer edge of the continental margin and adjacent areas;

(c) If financially possible, entering into joint ventures with appropriate research institutions for particularly critical research projects.

10. A major challenge for a State with limited resources may be to keep track of all research activity and the associated data acquired on its continental shelf through time. A second challenge is to find a place to store the copies of all the research data and information that according to articles 248 and 249 are to be made available to the State. With the particular needs of developing countries in mind, we should seek to establish an infrastructure for storage and easy retrieval, and for keeping track of appropriate data sets that are still being processed by the research institution. This infrastructure should be established under a politically and nationally neutral organization to ensure integrity. At the same time it must have access to the human expertise and facilities, including computer and communication equipment, to handle these types of data. Within the framework of the United Nations, the GRID system of the United Nations Environment Programme (UNEP) may be a suitable candidate to host and develop a centre for research data from the outer continental margin intended to serve the needs of coastal States, and developing countries in particular.

C. Marine scientific research and the transfer of marine technology, including capacity-building. A plan of action for assisting a developing region in drawing up a scientifically based integrated ocean management regime

11. The state of the world's living marine resources continues to be of concern for the international community. Several factors add to the pressure on resources, such as:

- (a) A continuing increase in the efficiency of fishing vessels;
- (b) Accumulated overcapacity in fishing fleets;
- (c) Increased population in coastal areas;
- (d) Rising prices for sea products in the world market.

12. To counteract this trend and promote sustainable utilization of the resources, concerted action is needed in several fields, as outlined in UNCLOS. The main tools available are:

- (a) Establishment of scientifically based management systems;
- (b) Effective monitoring, control and surveillance systems for the fisheries (MCS systems);
- (c) Scientific monitoring of the resource base and the environment.

13. While regulatory regimes are usually well established and allocated considerable resources in the industrialized parts of the world, many developing countries and regions do not at present have sufficient human and financial resources to establish such measurements on an effective scale. At the same time they are fully exposed to all the above-mentioned pressures that lead to depletion of the resources. The situation is therefore especially serious in those countries and regions. Article 266 of UNCLOS obliges the international community to assist in the development of the scientific and technological capacity of developing States when requested, with a view to accelerating their social and economic development.

14. A management regime is no stronger than the weakest link in the chain, and therefore a concerted and balanced action is needed to establish management

regulations and MCS systems for the fisheries based on research on the resource base. The establishment of a management regime demands considerable resources as regards infrastructure, technical instrumentation (including research vessels) and development of the necessary human knowledge base and skills. Building institutional capacities is a long-term process, and occasional setbacks should be expected. In the developing world it is almost impossible to develop a single public sector, such as a fisheries management system, isolated from the rest of society. Highly developed skills are also needed in other sectors, both private and public, and will over time move towards where the best terms are offered. Development of a management regime must therefore also contain a plan on how to retain the knowledge that is accumulated.

15. In areas where there is an industrial fishery present, the cost of running the management regime can be gradually transferred to it, but where there are extensive small-scale fisheries this is a more complicated issue. In such cases, development assistance to set up and run a management regime is expected to be needed for a longer period of time.

16. Over time, data from an effective MCS system can provide important information about the state of the exploited resources included in the management regime, but such indirect methods have serious limitations if the ecosystem is highly dynamic or where anomalies occur. In such cases direct methods such as resource and environmental surveys produce more relevant data for adequate management decisions. Modern research vessels are costly to build and operate and their operation maintenance require expertise that is in great demand. Thus, the costs of acquiring and running a research vessel are often too great for a developing nation before the management regime is well established, and it should be seen as an international responsibility to assist a developing fishing nation in this early critical phase.

17. In many cases the extent of the resources to be surveyed and the research tasks to be undertaken do not require a vessel to be available all year round. Moreover, fish resources, more often than not, are distributed across national borders and are thus shared resources with neighbouring countries. If this is the case, a national survey only gives an incomplete picture. In the same way, environmental problems mostly transit borders. In such cases joint surveys using one or more vessels are more appropriate. The

need for survey vessels can thus be more a demand on the regional level than on the national level.

18. Norway has more than 25 years of experience of running a modern research vessel, which has been put at the disposal of developing fishing nations and run in cooperation with the Food and Agriculture Organization of the United Nations (FAO), and at times also funding from the United Nations Development Programme (UNDP). For the first 15 years the vessel, the *Dr. Fridtjof Nansen*, was used to map new resources and monitor the resources of established fisheries in developing countries. These tasks were offered as input to national management, but without including these institutions' capacity to handle such information effectively. In the subsequent 10 years the monitoring of resources and the environment has been an element of a more integrated plan involving capacity-building in research and management through institutional cooperation, and support for the development of an MCS system, in the case of Namibia. This integrated effort has been an important factor towards a sustainable management regime in Namibia, which now largely is independent in terms of both funding and research, allowing the Norwegian contributions to be phased out gradually.

19. The report of the Secretary-General on oceans and the law of the sea lists a number of marine research programmes, mostly focusing on oceanography, the environment or climate change. At the same time international research projects to monitor the state of world marine resources are more limited, both in number and in scope. In the past 15 years, a lack of funding has forced FAO to scale back its natural resources projects in the developing world, and reports on the state of the world marine resources have become dependent on fishery information of varying quality. To obtain more accurate information on the true state and direction of development of marine resources and trends in the marine environment, it is necessary to revive training and monitoring on a larger scale, with substantial support from the developed world. If this is to succeed, we need a concerted action, that deals with all aspects of management regimes. In addition, the recipient States must make clear commitments to follow a programme for taking over full responsibility for the management system, both financially and in terms of human resources, once it has become fully operational.

20. **A plan of action for a developing region could consist of the following elements:**

- (a) A full review of the history and status of management for a region;**
- (b) A plan for an integrated programme for fisheries management, including monitoring of resources, implementing an MCS system and a plan for capacity-building in all relevant fields;**
- (c) Commitment from institutional partners in the developed world and from financial institutions;**
- (d) A plan for stepwise transfer of financial and professional responsibilities so that the region can become self-reliant.**

Critical factors will be:

- (i) Whether the country/region has a strategy to cope with brain drain to neighbouring sectors;**
- (ii) The development of a system where part of the revenue accumulated from the fisheries is used to finance the management system;**
- (iii) Whether the international community is prepared to contribute with resources to set off the project;**
- (iv) Whether the United Nations organizations dealing with the issue (FAO, UNDP) can provide sufficient resources and thus create with the other partners the momentum for a real change in attitudes and in the management regime.**

D. Marine science and technology and the need to adopt an ecosystem approach to the management and protection of marine ecosystems. A plan of action to assist a developing region in devising a scientifically based ecosystem approach to the management and protection of marine ecosystems

21. Marine ecosystems are open systems. Ocean currents flow through them carrying plankton organisms and chemical substances, including pollutants. Fish and other organisms may migrate

extensively across any defined ecosystem boundaries. Marine ecosystems are also characterized by high variability. This is related to the mode of reproduction of many fish and planktonic and benthic (bottom-dwelling) organisms which release large numbers of small eggs or larvae into the water to be dispersed and transported with the ocean currents. Only two of the large number of eggs produced by a female need to survive to reproduce in order to maintain the population over time.

22. The strong association between populations of marine organisms and the ocean currents and physics makes ocean climate variability a primary driving force for marine ecosystem variability. In addition there are strong biological interactions, such as predator-prey relationships, among the populations of organisms inhabiting a marine ecosystem. The variability of the ocean climate and the biological interactions work in concert to determine the dynamics of the constantly changing states of marine ecosystems.

23. Humans are part of marine ecosystems through their use of the seas and coastal waters for a number of different purposes, such as fisheries, aquaculture, shipping, etc. The various human activities have an impact not only on the same ecosystems, but also to a considerable extent, directly or indirectly, on the same components of marine ecosystems.

24. The need to adopt an ecosystem approach to the management and protection of marine ecosystems has already been recognized. In the Statement of Conclusions of the Intermediate Ministerial Meeting in 1997 in the North Sea Conference framework, the ministers and European Union commissioners stated (para. 2.6) that further integration of fisheries and environmental protection, conservation and management measures should draw upon the development of an ecosystem approach.

25. At a Workshop on the Ecosystem Approach to the Management and Protection of the North Sea, held at Oslo in June 1998, a conceptual framework for an ecosystem approach was developed. In June 2000, the Advisory Committee on the Marine Environment (ACME) of the International Council for the Exploration of the Sea (ICES) considered this and other similar frameworks. ACME proposed the following definition for an ecosystem approach to ocean management:

“Integrated management of human activities based on knowledge of ecosystem dynamics to achieve sustainable use of ecosystem goods and services, and maintenance of ecosystem integrity.”

ACME also proposed a general framework for an ecosystem approach. This identified the following five modules in repetitive sequence in a management process: Ecosystem objectives;

- Monitoring and research;
- Integrated assessment;
- Advice;
- Adaptive management.

26. Work is in progress to develop ecosystem objectives for the management of the North Sea. A workshop on Ecological Quality Objectives (EcoQOs) for the North Sea was held in Scheveningen, the Netherlands, in September 1999. A set of 10 issues was agreed for which EcoQOs may be developed in subsequent work. This work is now in progress in ICES, the OSPAR Commission and in a special project organized by the Netherlands and Norway.

27. ICES and the Intergovernmental Oceanographic Commission (IOC) of the United Nations Economic and Social Council (UNESCO) have established a joint Steering Group on the Global Ocean Observing System (GOOS) to promote the development of GOOS activities in the North Atlantic. The Steering Group has planned an ICES/IOC/OSPAR/EuroGOOS workshop on North Sea monitoring to be held in September 2001. The aim is to harmonize the monitoring of living marine resources and the environment in the North Sea so as to improve cost-efficiency through international cooperation and to support the development of an ecosystem approach.

28. An integrated environmental assessment is a comprehensive analysis and statement on the status of the environment, environmental trends and the extent of the impact of a range of human activities. There are two main challenges in conducting an integrated environmental assessment:

- (a) Any influence of human activities must be distinguished from the background of large natural variability;

(b) The effects of different human activities must be distinguished from each other.

29. OSPAR has recently completed a comprehensive assessment of the North-east Atlantic, as published in the OSPAR Quality Status Report 2000. Fisheries and various forms of pollution are identified as the major environmental concerns in this sea area. Although this assessment was a comprehensive process involving many scientists and experts over a five-year period and drawing on many available data sources, our ability to draw firm conclusions about the state of marine ecosystems and the impacts of human activities is still so limited as to be cause for concern.

30. The implementation of an ecosystem approach to the management and protection of the North Sea will be a central issue at the Fifth North Sea Conference in March 2002. It is to be hoped that this will improve the status of the exploited resources and the environmental quality of the North Sea. It may also serve as an example that may help similar development in other sea areas.

31. An evaluation of the appropriate scale is a key element in ecology and for the application of an ecosystem approach. Ecological processes occur at a continuum of scales from very small (e.g. the micro-environment surrounding a single phytoplankton cell) to very large (e.g. the global climate system). For practical management purposes, however, three main scales can be distinguished:

- Global
- Large marine ecosystem
- Local

32. Large marine ecosystems (LMEs) are defined as extensive regions, typically greater than 200,000 km², having unique hydrographic regimes, submarine topography, productivity and trophically dependent populations. This is the typical scale of commercial fish stocks. Fish stocks have a geographical closure of their life cycles, in which spawning migration to defined spawning areas, drift of fish larvae to suitable nursery areas and feeding migrations of juvenile and adult fish are major components. Since this geographical closure of life cycles is related to ocean currents and flow patterns, there is a close link between the submarine topography and hydrographic regimes, on the one hand, and major populations of commercial

fish species on the other, in the context of defined LMEs.

33. Globally, about 50 LMEs located on continental shelves have been identified as appropriate units for scientifically supported management. Typically the LMEs span the exclusive economic zones of several neighbouring coastal States. This is, for example, the case for the LMEs covering the Norwegian exclusive economic zone, i.e. the North Sea, the Norwegian Sea and the Barents Sea. An important task is the promotion of a framework for international cooperation for the management and protection of the world's LMEs.

34. The world ocean is a continuous medium that links all LMEs. The variability of the ocean climate, which is a primary driving force for variability in living marine resources and the state of ecosystems, needs to be addressed at the global and/or large regional scale. This is important as a means of improving our ability to predict climate variability through insight into underlying mechanisms and carrying out climate change impact assessments. Through downscaling techniques, global or large regional-scale ocean climate descriptions and predictions can be used as an analytical tool to improve the assessments of living marine resources and environmental conditions in specific LMEs.

35. There are many issues in the coastal and inshore marine environment that should be addressed at the local level. At the same time it is important to assess the combined effects of all human activities in a coastal zone for the well-being of populations and the integrity of the larger ecosystem which they inhabit. The LME is an appropriate scale for such integrated environmental assessment.

36. A plan of action for an ecosystem approach may include the following:

(a) Stronger international cooperation is needed to promote and support the development of the ecosystem approach. This applies to cooperation across the traditional divides between applied and academic research, between monitoring and research, and between living marine resources and marine environmental protection agencies. While the ecosystem approach broadens the scope from traditional sectoral management, it provides at the same time an overall framework that helps set

priorities and promotes synergy, cost-efficiency and ecosystem sustainability.

(b) Various United Nations organizations can and should play central roles in the further development of an ecosystem approach. The GOOS programme run by IOC and WMO is a core element. For its successful implementation it is necessary to have the fisheries science community on board as enthusiastic participants in the process. Thus extensive participation by FAO should be encouraged.

(c) GOOS is an operational programme that will be implemented and further developed on the basis of existing national and international monitoring activities. It is to be hoped that the planned development of a North Sea ecosystem GOOS component will serve as a demonstration project for the usefulness of this approach. Similar efforts should be encouraged elsewhere.

(d) A number of international marine research programmes are examining ecological processes and mechanisms in detail. Examples of such programmes are Global Ocean Ecosystem Dynamics (GLOBEC), Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB), and Joint Global Ocean Flux Study (JGOFS). Field investigations in these programmes should be coordinated as far as possible with ongoing monitoring (e.g. GOOS) and other research activities. This will allow more in-depth studies of ecosystem dynamics and reap the benefits of synergy between the various research programmes.

(e) It is not possible to carry out extensive ecosystem studies in all LMEs in the short term. By concentrating on some selected cases, we will achieve a better basic understanding. This will benefit the management of particular LMEs, but the experience and results will be transferable and can benefit scientific investigations and the management of other LMEs. This applies to the general approach and methodology of marine ecosystem research and also to some extent to knowledge about interactions and mechanisms governing the dynamics of LMEs. However, particular environmental conditions and the species of organisms present must be taken into careful consideration when results and experiences are transferred to other LMEs.

(f) Test cases of LMEs used for combined monitoring and research sites to support an ecosystem approach to management should also be used for the purpose of training and capacity-building.

