STELLUNGNAHMEN UND BERICHTE

Obligation to Co-operate in Marine Scientific Research and the Conservation of Marine Living Resources

*Yoshifumi Tanaka**

I. Introduction

A. Nature of the Problem

There is little doubt that rules regulating the use of the ocean must be based on the sound scientific understanding of the marine environment. Thus, the conduct of marine scientific research becomes important to the development of the international law of the sea.[1] In this respect, it would appear that due to highly complex nature of the ocean, even the strongest countries with the strongest marine scien-

* Research Fellow, Marine Law and Ocean Policy Centre, Martin Ryan Institute, National University of Ireland, Galway. The author wishes to thank Professor Clive Symmons for his useful comments.

[1] The following are of particular interest on this issue. F.H.T. Wegelein, Marine Scientific Research: The Operation and Status of Research Vessels and Other Platforms in International Law, Leiden et al. 2005; M. Gorina-Ysern, An International Regime for Marine Scientific Research, New York 2003; J.A. Roach, Marine Scientific Research and the New Law of the Sea, (1996) 27 ODIL, 59-72; E. Jarmache, Sur quelques difficultés de la recherche scientifique marine, in: La mer et son droit, Mélanges offerts à Laurent Lucchini et Jean-Piere Quéneudec, Paris 2003, 303-314; A. de Marffy, Marine Scientific Research, in: R.-J. Dupuy/D. Vignes (eds.), A Handbook on the New Law of the Sea Vol. 2, Dordrecht et al. 1991, 1127-1146; A. de Marffy, Les difficultés posées par la mise en application du nouveau régime de la recherche scientifique marine avant l'entrée en vigueur de la Convention des Nations unies sur le droit de la mer, (1989) 35 AFDI, 736-751; T. Treves, Principe du consentement et nouveau régime juridique de la recherche scientifique marine, in: D. Bardonnet/M. Virally (eds.), Le nouveau droit international de la mer, Paris 1983, 269-285; A.H.A. Soons, Marine Scientific Research and the Law of the Sea, Antwerp et al. 1982; L. Caflisch/J. Piccard, The Legal Régime of Marine Scientific Research and the Third United Nations Conference on the Law of the Sea, ZaöRV 38 (1978), 848-901; United Nations, Office for Ocean Affairs and the Law of the Sea, The Law of the Sea: Marine Scientific Research, A Guide to the Implementation of the Relevant Provisions of the United Nations Convention on the Law of the Sea, New York 1991.

tific capacity could not clarify mechanisms of the ocean alone. Hence, it is natural that international co-operation is required in marine scientific research.[2]

At present, such a co-operation is particularly important in the conservation of the marine living resources. Marine living resources constitute an increasingly important protein resource in a situation of food shortage at the global level. As the resources are renewable, there is a strong need to pursue conservation policies in order to prevent over-exploitation.[3] The proper conservation measures become possible only on the basis of sufficient and credible scientific data relating to harvested species. Hence, it may be said that the conduct of marine scientific research obtaining reliable scientific data is a prerequisite for the rational exploitation of marine resources.[4] Furthermore, it must be noted that the assessment of the marine scientific data directly influence the allocation of total allowable catch (TAC). Consequently, as typically shown in the *Southern Bluefin Tuna* case of 1999, divergence in opinions concerning scientific evidence may produce international disputes concerning TAC. Thus, importance would be underscored for international co-operation in marine scientific research with a view to collecting and assessing scientific information as objective as possible. In light of the increasing need for international co-operation in marine scientific research, it is important to examine the questions to what extent the legal basis for such a co-operation exists in the international law of the sea and how it is possible to enhance international scientific co-operation.

Against this background, this study seeks to examine the obligation to co-operate in marine scientific research in the context of the conservation of marine living resources. After briefly clarifying the concept of marine scientific research in Part I, Part II will address the obligation to co-operate in marine scientific research in global and regional legal documents. In Part III, the interrelationship between marine scientific research and the ecosystem approach as well as precautionary approach will be studied. Furthermore, Part IV will examine the conditions to enhance effectiveness of the obligation to co-operate in marine scientific research. Finally, general conclusion will be added in Part V.

B. Concept of Marine Scientific Research in International Law

In the ordinary meaning, the term "marine scientific research" may be defined as any scientific study or related investigation, wherever conducted, having the ma-

[2] R.J.H. Beverton, Introduction, in: E.D. Brown/R.R. Churchill (eds.), The UN Convention on the Law of the Sea: Impact and Implementation, Proceedings of Law of the Sea Institute Nineteenth Annual Conference, Honolulu 1987, 363.

[3] C.A. Fleischer, Fisheries and Biological Resources, in: Dupuy/Vigne (note 1), 992.

[4] Soons (note 1), 15. This point is currently stressed in international documents. See for instance FAO, The State of World Fisheries and Aquaculture 2002, 59-65 [PDF version]. This document is available at the homepage of FAO < http://www.fao.org/documents/>.

rine environment as its object.[5] The term "marine environment" is understood to cover three elements, i.e., seabed and the subsoil, adjacent water column and the atmosphere above the sea.[6] Obviously the marine environment contains marine life. It would seem to follow that the concept of marine scientific research covers any scientific investigation, however and wherever, which concerns the marine environment as well as its organisms.[7] On the other hand, scientific research not concerning the marine environment, such as astronomical observations carried out at sea, is not regarded as marine scientific research.[8]

In the international law of the sea, marine scientific research is usually divided into two rubrics: the "fundamental" or "pure" research and "applied" or "resource-oriented" research. This distinction dates back to the 1958 Geneva Convention on the Continental Shelf,[9] and is maintained in the 1982 UN Convention on the Law of the Sea (hereafter the 1982 LOSC). Although the 1982 LOSC does not define the precise meaning of the two types of research, "fundamental research" may be regarded research which is carried out "exclusively for peaceful purposes and in order to increase scientific knowledge of the marine environment for the benefit of all mankind".[10] On the other hand, "applied research" can be considered that which is of "direct significance for the exploration and exploitation of natural resources".[11] Examples of applied research include chemical oceanographic investigations conducted for the purpose of the regulation of marine pollution, physical oceanographic investigations carried out for the purpose of enhancing long-range weather forecasting, and marine biological investigations for the purpose of the

[5] Soons (note 1), 6-7 and 124. See also T. Treves, Marine Research, in: R. Bernhardt (ed.), Encyclopedia of Public International Law, Amsterdam 1997, 295.

[6] A.H.A. Soons, Marine Scientific Research Provisions in the Convention on the Law of the Sea: Issues of Interpretation, in: E.D. Brown/R. Churchill (note 2), 366. In particular, it is important to note that the marine environment also contains the atmosphere above the oceans. For instance, the concept of internal waters as well as territorial seas cover the air space above these waters. Furthermore, concerning the EEZ, Article 58 (1) of LOSC stipulates that "[i]n the exclusive economic zone", all States enjoy the freedoms of overflight. It follows that the airspace over the EEZ is to be considered part of the EEZ. Soons and Kuwahara in particular stress this point. Soons (note 1), 177; T. Kuwahara, International Law of the Sea (in Japanese), Tokyo 2002, 121.

[7] Cf. Soons (note 6), 366.

[8] Ibid., 367.

[9] Caflisch/Piccard (note 1), 849. On this point, Article 5 (1) of the Geneva Convention on the Continental Shelf provides that the exploration and the exploitation of the continental shelf must not result in "any interference with fundamental oceanographic or other scientific research carried out with the intention of open publication", while Article 5 (8) stipulates that the consent of the coastal states shall be obtained in respect of "any research concerning the continental shelf and undertaken there". Article 5 (8) further adds that such consent shall not be "normally" withhold "if the request is submitted by a qualified institution with a view to purely scientific research into the physical or biological characteristics of the continental shelf".

[10] Article 246 (3) of the 1982 LOSC.

[11] R. Churchill/V. Lowe, The Law of the Sea, 3rd ed., Manchester 1999, 405-406. With respect to the distinction between the fundamental research and applied research, see Caflisch/Piccard (note 1), 848-853; Soons (note 1), 6-7 and 124. See also Soons (note 6), 366-367.

management of marine living resources.[12] As embodied in the 1958 Geneva Convention on the Continental Shelf as well as the 1982 LOSC, usually the concept of marine scientific research covers both kinds of research. Thus, the reference to "marine scientific research" in this study also refers to the two types of research.[13]

For the purpose of this study, "international co-operation in marine scientific research" may be understood in a broad sense to cover collaboration in the conduct of marine scientific research *per se* as well as the contribution or exchange of scientific information.[14] As almost all scientific work is conducted on the basis of the results of earlier investigations, the exchange of data has become an important condition for the progress of marine scientific research. In this regard, it is notable that the recent expansion of marine scientific research as well as the use of newly developed techniques have produced an enormous increase in the volume of oceanographic data.[15] Consequently, international co-operation is required in the exchange and the management of marine scientific data. In addition, it should be noted that in certain circumstances, international collaboration between States and international organisations, such as the International Seabed Authority, is also needed in the conduct of marine scientific research.

II. Obligation to Co-operate in Marine Scientific Research in the Law of the Sea

A. The UN Convention on the Law of the Sea (1982)

1. General Obligations

In section 2 of Part XIII, the 1982 LOSC provides obligation to co-operate in marine scientific research in a general manner. In this regard, Article 242 (1) stipulates:

[12] Soons, (note 1), 7.

[13] The marine scientific research should be distinguished from the exploration (and exploitation) of natural resources since the latter is governed by a legal framework different from that regulating marine scientific research. In this regard, Soons defines exploitation as "data-collecting activities (scientific research) concerning natural resources, whether living or non-living, conducted specifically in view of the exploitation (i.e., economic utilization) of those natural resources". Soons (note 6), 367. In practice, however, it appears often difficult to make this distinction since the techniques used may sometimes be identical. Soons (note 1), 7. See also Wegelein (note 1), 82-89.

[14] In fact, as indicated in the text, the obligation to promote the flow of scientific data as well as the transfer of scientific knowledge is provided in section 2 of Part XIII concerning international co-operation in marine scientific research.

[15] Soons (note 1), 17. In this connection, there is a problem that in particular old scientific data could be lost from scientific memory because of poor data management or major political and social disruptions. On this issue, see D. Zeller/R. Froese/D. Pauly, On Losing and Recovering Fisheries and Marine Science Data, (2005) 29 Marine Policy, 69-73.

"States and competent international organisation shall, in accordance with the principle of respect for sovereignty and jurisdiction and on the basis of mutual benefit, promote international co-operation in marine scientific research for peaceful purposes."[16]

More specifically, Article 243 requires States and competent international organisations to co-operate "to create favourable conditions for the conduct of marine scientific research in the marine environment and to integrate the efforts of scientists in studying the essence of phenomena and processes occurring in the marine environment and the interrelations between them". Such co-operation is to be undertaken through the conclusion of international agreements. The need for co-operation in marine scientific research is further amplified in Article 255, which requires States to adopt reasonable rules and procedures to promote marine scientific research.[17] Moreover, Article 244 (2) ensures that States, both individually and in co-operation with other States and with competent international organisations, shall actively promote the flow of scientific data and the transfer of knowledge resulting from marine scientific research, especially to developing States. This obligation is also reflected in Annex VI of the Final Act of the 1982 LOSC.[18] These obligations become particularly important in the conservation and management of marine living resources since reliable data concerning species to be harvested is a prerequisite for the establishment of an effective management scheme.

2. Obligation to Co-operate in Marine Spaces under National Jurisdiction

Article 2 of the 1982 LOSC provides that: "[t]he sovereignty of a coastal State extends, beyond its land territory and internal waters and, in the case of an archipelagic State, its archipelagic waters, to an adjacent belt of sea, described as the territorial sea." Thus, except for the right of innocent passage of foreign ships in the territorial sea, internal waters as well as territorial sea, including its seabed and subsoil and the superjacent air space, falls under the exclusive jurisdiction of the coastal State.[19] Consequently, any research to be conducted in internal waters as well as territorial sea by foreign States or by international organisations requires

[16] Furthermore, it appears that a duty of co-operation in general context is implicit in Article 251 which requires States to "promote through competent international organisations the establishment of general criteria and guidelines to assist States in ascertaining the nature and implications of marine scientific research."; and in Article 255 that obliges States to "endeavour to adopt reasonable rules, regulations and procedures to promote and facilitate marine scientific research […]". On this point, see M.C.W. Pinto, The Duty of Co-operation and the United Nations Convention on the Law of the Sea, in: A. Bos/H. Siblesz (eds.), Realism in Law-Making, Essays on International Law in Honour of Willem Riphagen, Dordrecht et al. 1986, 143.

[17] M.H. Nordquist et al. (eds.), United Nations Convention on the Law of the Sea 1982: A Commentary, Vol. IV, The Hague et al. 1991, hereafter the Virginia Commentary, 477.

[18] Annex VI is entitled as "Resolution on Development of National Marine Science, Technology and Ocean Service Infrastructures".

[19] In relation with this Article 21 (1) (g) of the LOSC provides that the coastal State may adopt laws and regulations in respect of marine scientific research and hydrographic survey.

the express consent of the coastal State.[20] Similarly, archipelagic waters are under the territorial sovereignty of the archipelagic States, and, thus, the conduct of marine scientific research in archipelagic waters calls for the authorisation of the archipelagic States. It follows that in marine spaces under territorial sovereignty, coastal States enjoy decisive powers over marine scientific research. It should be noted, however, that in enclosed or semi-enclosed seas, bordering States should co-operate to co-ordinate their scientific research policies and undertake where appropriate joint programmes of scientific research in the area in accordance with Article 123 (c).

In the EEZ and on the continental shelf, marine scientific research shall also be conducted with the consent of the coastal State. Yet, coastal States shall, "in normal circumstances", grant their consent for marine scientific research projects by other States or competent international organisations, which is "exclusively for peaceful purpose and in order to increase scientific knowledge of the marine environment for the benefit of all mankind".[21] In order to achieve the purpose of increasing "scientific knowledge of the marine environment for the benefit of all mankind", arguably international scientific co-operation will be essential.[22] In connection with this, Article 249 (1) provides certain conditions that shall be complied with by foreign States or international organisations in undertaking marine scientific research with the approval of the coastal State. Such conditions contain: ensuring the right of the coastal State to participate in the marine scientific project, providing the coastal State with the final results and conclusions, providing access for the coastal State to all data and samples derived from the marine scientific research project, providing the coastal State with an assessment of such data, samples and research results, and ensuring that the research results are made internationally available etc. These conditions are provided with a view to balancing the interests of the coastal State and the interests of researching States or international organisations.[23] At the same time, it would appear that to some extent, these conditions may contribute to enhance international co-operation by ensuring the participation of the coastal States as well as the publication of the results.[24]

Furthermore, it would seem that international scientific co-operation in a broad sense may be required in the conservation of living resources in the EEZ. Whereas the coastal State has sovereign rights over natural resources in its EEZ, the coastal

[20] See also Article 19 (2) (j). It should be remembered that Article 242 (1) of the LOSC prudently adds the words "in accordance with the principle of respect for sovereignty and jurisdiction". In addition, being the territorial sea, international straits are also under the sovereignty of the coastal State. Thus, the same conclusion applies to the conduct of marine scientific research in international straits.

[21] Article 246 (3). Under Article 297 (2) (a) (i), however, the coastal State is not obliged to accept the submission to the compulsory procedures embodied in Part XV of any disputes arising out of the exercise by the coastal State of a right or discretion in accordance with Article 246.

[22] Jarmache (note 1), 308.

[23] Virginia Commentary, Vol. IV (note 17), 540.

[24] Yet, it should be noted that the coastal State enjoys full discretion as regards the granting of consent to publish the research results under Article 249 (2).

State is obliged to properly conserve the living resources "taking into account the best scientific evidence available".[25] In this respect, Article 61 (5) stipulates that available scientific information relevant to the conservation of fish stocks shall be contributed and exchange on a regular basis through international organisations with participation by all States concerned, including States whose nationals are allowed to fish in the EEZ.[26] Those obligations may stimulate international co-operation in the exchange of scientific data, and diminish the risk of unilateral manipulation of data.[27] In addition, Part V of the 1982 LOSC concerning the EEZ adopts a distinct species-specific approach concerning each of the following categories: straddling fish stocks (Article 63), highly migratory species (Article 64), marine mammals (Article 65), anadromous stocks (Article 66), catadromous species (Article 67). In order to conserve these species, it is necessary to investigate their migrations across EEZs and high seas. In particular, it would seem that considerable studies will be needed with respect to movements of anadromous and catadromous species between their rivers of origin, internal and territorial seas, EEZs, and, as appropriate, high seas. Such studies will necessitate international scientific co-operation between the coastal States and other States seeking access to such fishing.[28] In reality, conventions concerning the conservation of anadromous stocks explicitly oblige Contracting Parties to co-operate in marine scientific research on these species.[29]

3. Obligation to Co-operate in Marine Spaces beyond National Jurisdiction

On the high seas, all States enjoy freedom of scientific research. At the same time, States are required to promote the exchange of marine scientific data on the high seas. In this regard, Article 119 (2) of 1982 LOSC calls upon all States to contribute available scientific information with respect to the conservation of the living resources of the high seas through competent international organisations.[30] It is argued that the obligation embodied in paragraph 2 is linked to the obligation in paragraph 1 (a) of the same provision, requiring all States to take conservation measures on the basis of "the best scientific evidence available to the States concerned". It is suggested that scientific information should include biological data, the migratory habitats of the species in question, the fishing gear and methods util-

[25] Article 61 (2).

[26] There is a parallel to this as regards Article 119 (2) relating to conservation of the living resources on the high seas.

[27] F. Orrego Vicuna, The Changing International Law of High Seas Fisheries, Cambridge 1999, 27.

[28] P. Birnie, Law of the Sea and Ocean Resources: Implications for Marine Scientific Research, (1995) 10 International Journal of Marine and Coastal Law (IJMCL), 238.

[29] See for instance, the 1999 Treaty between Canada and the United States concerning Pacific Salmon, the 1992 Convention for the Conservation of Andromous Stocks in the North Pacific Region.

[30] Virginia Commentary (note 17), Vol. III, 1995, 312.

ised in harvesting those species, and the landing of each species, including incidental catches. Considering that statistics on high seas fisheries are still sporadic at best, the exchange of data is an important condition for the conservation of marine living resources.[31]

Furthermore, currently special attention should be drawn to marine scientific research in the Area, i.e. the sea-bed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction. In 1977, scientists discovered a unique ecosystem at sites in the deep seabed where high temperature fluids rich in reduced compounds pour out into the water column. Nowadays it is estimated that the Area may be home to 10 million species of organisms.[32] As some of these species, in particular micro-organisms, present great interest for biotechnology, the use of the genetic resources of the deep-seabed has become a matter of increasing international concern.[33] Nevertheless, evidence suggests that unique ecosystems in the deep seabed have been threatened by fishing activities, deep seabed mining as well as marine scientific research itself.[34] In order to minimise any impact on the deep seabed ecosystems from scientific investigation, it is acknowledged that there is a need for better co-ordination among marine scientific research programmes.[35]

In this respect, it should be remembered that under Article 143 (1) of the 1982 LOSC, marine scientific research in the Area shall be carried out exclusively for peaceful purposes and for the benefit of mankind as a whole, in accordance with Part XIII. Furthermore, Article 143 (3) makes it clear that States Parties shall promote international co-operation in marine scientific research in the Area by: (a) participating in international programmes and encouraging co-operation in marine scientific research by personnel of different countries and of the Authority; (b) ensuring that programmes are developed through the Authority or other international organisations as appropriate for the benefit of developing States and technologically less developed States; and (c) effectively disseminating the results of re-

[31] Ibid.

[32] United Nations General Assembly, Report of the Secretary-General, Oceans and the Law of the Sea, A/59/62, 4 March 2004, 60, para. 234.

[33] With respect to this issue, see T. Scovazzi, The Evolution of International Law of the Sea: New Issues, New Challenges, (2000) 286 RCADI, 213-220; L. Glowka, The Deepest of Ironies: Genetic Resources, Marine Scientific Research, and the Area, (1996) 12 Ocean Yearbook, 154-178; L. Glowka, Genetic Resources, Marine Scientific Research and the International Seabed Area, (1999) 8 RECIEL, 56-66; P. Ré, Deep-Sea Hydrothermal Vents "Oases of the Abyss", in: J.-P. Beyruer/A. Kiss/S. Mahmoudi (eds.), New Technologies and Law of the Marine Environment, London 1999, 67-74; I. Mgbeoji, (Under) Mining the Seabed? Between the International Seabed Authority Mining Code and Sustainable Bioprospecting of Hydrothermal Vent Ecosystems in the Seabed Area: Taking Precautionary Seriously, (2004) 18 Ocean Yearbook, 413-452.

[34] United Nations, Report of the Secretary-General, (note 32), 62, para. 245. On this point, the UN General Assembly Resolution 58/240 of 2003 has reiterated "*its call* for urgent consideration of ways to integrate and improve, on a scientific basis, the management of risks to the marine biodiversity of seamounts, cold water coral reefs and certain other underwater features". See para. 51.

[35] International Seabed Authority, Report of the Secretary-General of the International Seabed Authority under Article 166, para. 4, of the United Nations Convention on the Law of the Sea, ISBA/10/A/3. 31 March 2004, 43, para. 134.

search and analysis when available, through the Authority or other international channels when appropriate. At the same time, the Authority is under the duty to promote and encourage the conduct of marine scientific research in the Area, and to co-ordinate and disseminate the results of such research and analysis when available under Article 143 (2). In fact, the Authority has promoted international collaboration with recognised scientists, representatives of contractors, the offshore mining industry and member States in the collection and dissemination of data through a series of workshops since 1998. For instance, in 2002, the Authority convened a workshop on the prospects for international collaboration in marine scientific research.[36] It would seem that the promotion of co-ordination and co-operation of marine scientific research in the Area is becoming an important aspect of the work of the Authority.[37]

B. The FAO Code of Conduct for Responsible Fisheries (1995)

Later on, the need for international co-operation in marine scientific research has been increasingly stressed in various international instruments relating to the conservation of marine living resources. For instance, the 1989 General Assembly Resolution 44/225, entitled "Large-scale Pelagic Driftnet Fishing and Its Impact on the Living Marine Resources of the World's Oceans and Seas", calls upon all those involved in large-scale pelagic driftnet fishing to co-operate fully with the international community in the enhanced collection and sharing of statistically sound scientific data.[38] Growing concern on international co-operation in marine scientific research can be detected in the 1995 FAO Code of Conduct for Responsible Fisheries in more detail. In this respect, it is important to note that the 1995 FAO Code of Conduct sets out a dual requirement relating to marine scientific research: the requirement of the conduct of marine scientific research by each State and the requirement to co-operate on this matter.[39]

[36] The workshop focused on four key issues: (a) levels of biodiversity, species range and gene flow in abyssal nodule provinces; (b) disturbance and recolonisation processes at seafloor following mining track creation and plume resedimentation; (c) mining plume impacts on the water column ecosystems; and (d) natural variability in nodule province ecosystems. Ibid., 41, para. 128.

[37] Ibid., 39-44, paras. 122-136. See also T. Scovazzi, Mining, Protection of the Environment, Scientific Research and Bioprospecting: Some Considerations on the Role of the International Sea-Bed Authority, (2004) 19 IJMCL, 383-409 (in particular, 397-399).

[38] UN General Assembly Resolution, A/RES/44/225, 22 December 1989, para. 2. For the text of the resolution, <http://www/oceanlaw.net/texts/ga44_225.htm>.

[39] The Code is a voluntary instrument relating to fisheries. See Article 1.1. However, certain parts of it are based on relevant rules of international law, including those reflected in the UN Convention on the Law of the Sea. Furthermore, the Code is global in scope, and is directed toward members and non-members of FAO, fishing entities, subregional, regional and global organisation, whether governmental or non-governmental, and all persons concerned with the conservation of fishery resources and management and development of fisheries (Article 1.2).

First, with respect to the requirement to conduct marine scientific research, Article 6.4 of the Code of Conduct states that:

> "States should assign priority to undertake research and data collection in order to improve scientific and technical knowledge of fisheries including their interaction with the ecosystem."[40]

Article 7.4 then stresses the need to compile fishery-related and other supporting scientific data relating to fish stocks by States as well as regional fisheries organisations or arrangements. More specifically, Article 12.5 provides that States should be able to monitor and assess the state of the stocks under their jurisdiction, including the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration; that States should also establish the research capacity necessary to assess the effects of climate or environment change on fish stocks and aquatic ecosystems. To this end, the Code of Conduct requires that States should establish a research capacity and support and strengthen national research capabilities to meet acknowledged scientific standards pursuant to Article 12.6. The results of such research should be made publicly available.[41]

Secondly, the Code of Conduct further calls for the international co-operation in marine scientific research. Article 7.3.4 of the Code of Conduct requires States as well as regional fisheries management organisations and arrangements to foster and promote international co-operation and co-ordination in all matters related to fisheries, including information gathering and exchange, fisheries research, management and development. Furthermore, States are required to "develop collaborative technical and research programmes to improve understanding of the biology, environment and status of transboundary aquatic stocks".[42] At the same time, competent international organisations should, upon request, render technical and financial support to States in their research efforts.[43] It is logical that international marine scientific co-operation presupposes the action of each State to undertake marine scientific research. In this sense, it may be said that the two requirements are closely interconnected.

C. The Straddling and Highly Migratory Fish Stocks Agreement (1995)

Significantly, the dual requirement set out in the Code of Conduct was clearly enshrined as a legal obligation in the 1995 Straddling and Highly Migratory Fish Stocks Agreement (hereafter the 1995 Fish Stocks Agreement).[44] Realising that

[40] Article 6.4.

[41] Article 12.8.

[42] Article 12.17.

[43] Articles 12.19 and 12.20.

[44] The title of this agreement is: 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.

there are problems of unreliable databases and lack of sufficient co-operation between States,[45] this agreement places an explicit obligation upon each State to undertake marine scientific research. Thus, Article 5 (k) calls for coastal States as well as States fishing on the high seas to "promote and conduct scientific research and develop appropriate technologies in support of fishery conservation and management".[46] Furthermore, States are under obligation not only to collect and exchange scientific, technical and statistical data with respect to fisheries for straddling and highly migratory fish stocks,[47] but also to obtain and evaluate scientific advice, review the status of the stocks and assess the impact of fishing on non-target and associated or dependent species.[48] States are also obliged to ensure that data are collected in sufficient detail to facilitate effective stock assessment and are provided in a timely manner to fulfil the requirements of subregional or regional fisheries management organisations.[49] Standard requirements for the collection and sharing of data are specified in detail in Annex I of the Agreement.[50] In so doing, it is argued that the 1995 Agreement greatly strengthens the obligations of States to collect and share marine scientific information enshrined in Articles 119 (2) and 61 (5) of the 1982 LOSC.[51] In connection with this, it is notable that Article 1 of Annex I requires that data collected should also include information on non-target and associated or dependent species. This requirement will be significant in implementing the ecosystem approach.

Due to their transfrontier nature, international co-operation is essential to the conservation of straddling and highly migratory species; and the marine scientific research, which provides for basic data concerning the conservation, is no exception. Thus, Article 14 (3) explicitly obliges States to co-operate to strengthen scientific research capacity in the field of fisheries and promote scientific research related to the conservation and management of straddling and highly migratory fish stocks for the benefit of all. Arguably the obligation to co-operate in the develop-

[45] Preamble of the 1995 Fish Stocks Agreement.

[46] See also Article 10 (g).

[47] Articles 14 (1) (a) and 10 (f).

[48] Article 10 (d).

[49] Article 14 (1) (b).

[50] Such requirements include: (a) the need to ensure that data are collected from vessels flying their flag on fishing activities according to the operational characteristics of each fishing method and in sufficient detail to facilitate effective stock assessment; (b) the need to ensure that fishery data are verified through an appropriate system; (c) the need to compile fishery-related and other supporting scientific data and provide them in an agreed format and in a timely manner to the relevant subregional or regional fisheries management organisation or arrangement where one exists; (d) the need to agree on the specification of data and the format; (e) the need for regional organisations to compile data and make them available in a timely manner and in an agreed format to all interested States under the terms and conditions established by the organisation or arrangement; and (f) the need that scientists of the flag State and from the relevant regional fisheries management organisations should analyse the data separately or jointly.

[51] M. Hayashi, The 1995 UN Fish Stocks Agreement and the Law of the Sea, in: D. Vidas/W. Østreng (eds.), Order for the Oceans at the Turn of the Century, The Hague 1999, 40.

ment of marine scientific capacity is particularly important to promote scientific and technical assistance to developing countries. Moreover, Article 3 (2) of Annex I of the 1995 Agreement requires States to collect and provide to the relevant subregional or regional fisheries management organisation information to support stock assessment. Such information include: (a) composition of the catch according to length, weight and sex; (b) other biological information supporting stock assessments, and (c) other relevant research, including surveys of abundance, biomass surveys, hydro-acoustic surveys, research on environmental factors affecting stock abundance, and oceanographic and ecological studies. It is worth noting that the 1995 Fish Stocks Agreement attempts to specify the contents of international scientific co-operation in some detail. In so doing, it may be said that the 1995 Fish Stocks Agreement further amplifies the obligation to co-operate in marine scientific research enshrined in the 1982 LOSC.[52]

D. Regional Agreements

The obligation of co-operation in marine scientific research is also increasingly reflected in regional agreements concerning the conservation of marine living resources.[53] As illustrated in the Table, such regional agreements concern various species, such as andromous stocks, cetaceans, highly migratory fish species and marine biological diversity. Considering that these species are in essence transboundary in their nature, it is understandable that marine scientific co-operation is required in investigating them.

Table: Obligation to Co-operate in Marine Scientific Research in International Instruments Concerning the Management of Marine Living Resources

Year	Title	Relevant Provisions
1959	Convention concerning Fishing in the Black Sea	Articles 1, 7
1962	Agreement Concerning Co-operation in Marine Fishing	Article 1
1980	Convention on the Conservation of Antarctic Marine Living Resources	Articles 3, 20[54]

[52] M. Hayashi, The Straddling and Highly Migratory Fish Stocks Agreement, in: E. Hey (ed.), Development in International Fisheries Law, The Hague 1999, 73. See also by the same author, The 1995 Agreement on the Conservation and Management of Straddling and Highly Migratory Fish Stocks: Significance for the Law of the Sea Convention, (1995) 29 Ocean and Coastal Management, 55.

[53] See Table. This table contains global as well as regional treaties. This list is not exhaustive.

[54] Article 3 of this convention provides that the Contracting Parties are bound by the obligation contained in Articles I and V of the Antarctic Treaty. Article III of the latter makes explicit the obligation to co-operate in scientific investigation in the Antarctic.

1982	Protocol Concerning Mediterranean Specially Protected Areas	Articles 13, 14, 15
1982	United Nations Convention on the Law of the Sea	Articles 242, 61 (5), 119 (2), 143 (3)
1991	Convention on Fisheries Co-operation among African States Bordering the Atlantic Ocean	Articles 3, 15
1992	Convention for the Conservation of Andromous Stocks in the North Pacific Region	Article 7
1992	Agenda 21*	Paras. 17.57, 17.87.
1992	Convention on Biological Diversity	Articles 17, 18
1992	Agreement on the Conservation of Small Cetaceans of the Baltic and North Sea	Article 2 of Annex
1993	Convention for the Conservation of Southern Bluefin Tuna	Article 5 (3)
1994	Convention on the Conservation and Management of Pollock Resources Central Bering Sea	Articles 2 (3), 10
1995	FAO Code of Conduct for Responsible Fisheries*	Articles 7.3.4, 12.17
1995	Straddling Fish Stocks and Highly Migratory Fish Stocks Agreement	Article 14
1995	Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean	Articles 20, 22
1996	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area	Articles 4 and 5 of Annex 2
1997	Protocol on the Conservation, Rational Utilisation and Management of Norwegian Spring Spawning (Atlano-Scandian Herring) in the North-East Atlantic	Article 5
1998	Agreement on the International Dolphin Conservation Program	Article 11 and Annex 6
1999	Treaty between Canada and the United States concerning Pacific Salmon	Articles 3, 10, 14
1999	Agreement Concerning the Creation of a Marine Mammal Sanctuary in Mediterranean	Article 12
2001	Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean	Articles 13, 21 (4)
2003	Treaty between Australia and France on Cooperation in the Maritime Areas Adjacent to the French Southern and Antarctic Territories (TAAF), Heard Island and the McDonal Islands	Article 2 and Annex II

* voluntary instrument

At the same time, those regional treaties cover a variety of areas, such as the Black Sea, the Mediterranean Sea, Antarctic, the Atlantic Ocean, the North Pacific Ocean, the Baltic and the North Sea, the Central Bering Sea, the North-East Atlantic as well as the South-East Atlantic Ocean. This factual situation shows that the need for international co-operation in marine scientific research is widely accepted in the conservation of various species as well as in various regions.[55] As the examination of each and every regional agreements beyond the scope of this study, only two examples will be provided here.

Concerning a bilateral agreement, an interesting example may be offered by the 1999 Treaty between Canada and the United States concerning Pacific Salmon.[56] Article X of this treaty places an obligation upon the Parties to conduct research to investigate the migratory and exploitation patterns, the productivity and the status of stocks of common concern and the extent of interceptions. Furthermore, Parties shall allow nationals, equipment and vessels of the other Party conducting research approved by the Commission to have access to its waters for the purpose of carrying out such research. In this connection, interestingly the Commission may make recommendations to the Parties regarding the conduct and co-ordination of research under Article X (2). Moreover, Article XIV (c) of the 1999 Treaty obliges each Party to exchange fisheries statistics and any other relevant information on a current and regular basis in order to facilitate the implementation of this Treaty. In so doing, it may be said that the 1999 Treaty clearly reflects the dual obligation relating to marine scientific research.

With respect to multilateral treaties on this issue, a typical example may be furnished by the 1992 Convention for the Conservation of Andromous Stocks in the North Pacific Region (hereafter the 1992 North Pacific Convention). The remit of this convention is to promote the acquisition, analysis and dissemination of scientific information pertaining to anadromous stocks and ecologically related species in the North Pacific Ocean. Thus, Article VII (1) imposes on the Parties to co-operate in the conduct of scientific research in the North Pacific Ocean and its adjacent seas beyond 200 nautical miles, for the purpose of the conservation of anadromous stocks including scientific research on other ecologically related species. Furthermore, Article VII (2) places an obligation upon the Parties to co-operate, as appropriate, in collecting, reporting and exchanging biostatistical information, fisheries data, including catch and fishing effort statistics, biological samples and other relevant data pertinent to the purposes of this Convention. Moreover, in accordance with Article VII (4), the Parties are under a duty to develop appropriate co-operation programmes, including scientific observer programmes, to collect fishing information in the Convention Area for the purpose of scientific research on anadromous stocks and, as appropriate, ecologically related species. The Parties shall further endeavour to co-operate in scientific exchanges such as seminars, workshops and, as appropriate, exchanges of scientific personnel necessary to

[55] Marine scientific research in regional agreements will be studied in Part IV.

[56] The text of the treaty is available at <http://www.oceanlaw.net/texts/pcs.htm>.

achieve the objectives of this Convention pursuant to Article VII (5). Significantly, such a scientific co-operation is controlled through a Commission, which is established in Article VIII. The controlling mechanisms through the Commission are worth noting, and will be studied in Part IV.

III. Interrelationship between Marine Scientific Research and New Approaches to the Conservation of Marine Living Resources

The above consideration demonstrates that the obligation to co-operate in marine scientific research is widely reflected in treaties concerning marine living resources at global and regional levels. It appears that this trend is *not* an isolated phenomenon, but is closely linked to the emergence of new approaches to the conservation of marine living resources in law of the sea. In this respect, the interrelationship between the conduct of marine scientific research and ecosystem as well as precautionary approaches is worth examining.

A. Linkage between Marine Scientific Research and the Ecosystem Approach

At present, it is becoming apparent that the intricate relationship of marine ecosystems and the environments that support them are important elements in the conservation of living resources as well as biological diversity of the seas; and that the traditional single-species approach is inadequate for the management of marine living resources. Thus, the need for the ecosystem approach is currently stressed in a number of international instruments relating to marine living resources.[57] While the term "ecosystem approach" has been variously defined in different settings, the Biodiversity Committee of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) of 1992 defined this approach as

> "the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity."[58]

[57] With respect to the analysis on State and treaty practices concerning the ecosystem approach, see H. Wang, Ecosystem Management and Its Application to Large Marine Ecosystems: Science, Law, and Politics, (2004) 35 ODIL, 41-74; S.M. Garcia/M. Hayashi, Division of the Oceans and Ecosystem Management: A Contrastive Spatial Evolution of Marine Fisheries Governance, (2000) 43 Ocean and Coastal Management, 461-463.

[58] Meeting of the Biodiversity Committee (BDC), Dublin, 20-24 January 2003, Summary Record BDC 2003, BDC 03/10/1-E, Annex 13, Ecosystem Approach to Management of Human Activities, 1,

The ecosystem approach focuses on biological interactions between all marine species in the same as well as in neighbouring zones, and the ecological conditions of the physical surroundings.[59] It is obvious that the conservation measures on the basis of the ecosystem approach must be based on sound scientific understanding of the marine ecosystems.[60] Considering that the knowledge of marine ecosystems is still inadequate, there will be a need for considerable marine scientific research concerning marine ecosystems in the application of this approach.

In this respect, science shows that the uniqueness of marine ecosystems frequently crosses maritime delimitation lines.[61] This is particularly true in the case of large marine ecosystems (LMEs), which are becoming a focal topic in ocean management.[62] Usually LMEs may be defined as "regions of ocean and coastal space that encompass river basins and estuaries and extend out to the seaward boundary of continental shelves and the seaward margins of coastal current systems".[63] LMEs are relatively large areas in the order of 200,000 square kilometres, and they annually produce 95 percent of the world's fish catch.[64] The factual situation is that LMEs often cover maritime spaces under national jurisdiction of several States.[65]

---

para. 6. Furthermore, Report of the Secretary-General of the United Nations defines a marine ecosystem as: "A marine ecosystem may be defined as the sum total of marine organisms living in a particular sea area, the interactions between those organisms and the physical environment in which they interact. A vulnerable marine ecosystem could be defined as one that is particularly susceptible to disruption, to damage or even to destruction due to its physical characteristics, the activities and interactions of the organisms therein and the impacts they suffer from human activities and the surrounding environment." United Nations, Oceans and the Law of the Sea, Report of the Secretary-General, A/58/65, 3 March 2003, 53, para. 172.

[59] N. Matz, The Interaction between the Convention on Biological Diversity and the UN Convention on the Law of the Sea, in: P. Ehlers/E. Mann-Borgese/R. Wolfrum (eds.), Marine Issues, 2002, 208.

[60] For instance, the 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) clearly stated in its preamble that "it is essential to increase knowledge of the Antarctic marine ecosystem and its components so as to be able to base decisions on harvesting on sound scientific information".

[61] L. Juda, Considerations in Developing a Functional Approach to the Governance Large Marine Ecosystems, (1999) 30 ODIL, 93-94.

[62] Garcia/Hayashi (note 57), 461. The concept of LMEs enjoys strong support by many international institutions, such as UNEP, UNDP, Global Environment Facility (GEF) and the World Bank etc. Ibid., 465; L.M. Alexander, Large Marine Ecosystems: A New Focus for Marine Resources Management, (1993) Marine Policy, 197.

[63] UN Atlas of the Ocean regards Large Marine Ecosystems (LMEs). At present, 64 LMEs have been identified in the world. The information on LMEs is available at <http://www.edc.uri.edu/lme/default.htm>.

[64] A.M. Duda/K. Sherman, A New Imperative for Improving Management of Large Marine Ecosystems, (2002) 45 Ocean and Coastal Management, 802.

[65] Maps of LMEs are available at <http://www.edc.uri.edu/lme/default.htm>. With respect to the large marine ecosystem, see M.H. Belsky, Management of Large Marine Ecosystems: Developing a New Rule of Customary International Law, (1985) 22 San Diego Law Review, 733-763; K. Sherman, Achieving Regional Co-operation in the Management of Marine Ecosystems: the Use of the Large Marine Ecosystem Approach, (1995) 29 Ocean and Coastal Management, 165-185; Alexander (note 62), 186-198; Duda/Sherman (note 64), 797-833; Wang (note 57), 45-46.

Due to its transboundary nature of marine ecosystems, international co-operation should be needed in the conduct of marine scientific research. In this regard, Article 6.4 of the Code of Conduct states that:

> "In recognising the transboundary nature of many aquatic ecosystems, States should encourage bilateral and multilateral co-operation in research, as appropriate."

In practice, the linkage between marine scientific research and the ecosystem approach is clearly supported by the International Council for the Exploration of the Sea (ICES).[66] ICES, established in 1902, is the world's oldest intergovernmental scientific organisation to co-ordinate scientific research,[67] and provides scientific information and advice relating to fish stocks to relevant institutions.[68] Since the early 1980s, ICES has assumed a leading position in developing the ecosystem approach.[69] In particular, the Advisory Committee on Ecosystems (ACE) was established in 2000 as the Council's official body for the provision of scientific information and advice on marine ecosystems, and on exploitation of living marine resources in an ecosystem context. From 2001, ACE is providing information and advice on marine ecosystems in accordance with requests from ICES Member countries as well as other organisations.[70] By offering such scientific data and advice, ICES assists policy-making concerning the management of marine living resources. As an example, a close relationship between ICES and North-East Atlantic Fisheries Commission (NEAFC) may be noted. Article 14 of the Convention on Future Multilateral Co-operation in North-East Atlantic Fisheries requires NEAFC to seek information and advice from the ICES on such matters as the biology and population dynamics of the fish stocks concerned, the state of the fish stocks, the effect of fishing on those stocks, and measures for their conservation and management. On the basis of such information provided by ICES, NEAFC adopts management measures concerning fish stocks.[71] In conclusion, it appears

[66] With respect to the structure and functions of ICES, see E.D. Anderson, The International Council for the Exploration of the Sea, in: R. Platzöder/P. Verlaan (eds.), The Baltic Sea: New Developments in National Policies and International Co-operation, The Hague et al. 1996, 271-287.

[67] Later, ICES was given a new constitution by the 1964 Convention as well as its 1970 Protocol.

[68] In fact, ICES is the officially recognised scientific advisory body to the following organisations: North-East Atlantic Fisheries Commission (NEAFC); International Baltic Sea Fishery Commission (IBSFC); North Atlantic Salmon Conservation Organisation (NASCO); and Commission of the European Communities.

[69] Anderson (note 66), 279; Alexander (note 62), 187.

[70] ICES Co-operation Research Report, No. 249, Report of the ICES Advisory Committee on Ecosystems, 2001; ICES Co-operation Research Report, No. 254, Report of the ICES Advisory Committee on Ecosystems, 2002; ICES Co-operation Research Report, No. 262, Report of the ICES Advisory Committee on Ecosystems, 2003. These reports are available at homepage of ICES. <http://www.ices.dk/index.asp>.

[71] On this point, see in particular Articles 5, 6, 7, 8, 9 and 10 of the NEAFC Convention. Such measures, known technically as "recommendations", are legally binding on members unless objected to during a specified period following their adoption in accordance with Article 12 of the NEAFC Convention. With respect to the linkage between NEAFC and ICES, see R.R. Churchill, Managing Straddling Fish Stocks in the North-East Atlantic: A Multiplicity of Instruments and Regime Linkage — but How Effective a Management?, in: O.S. Stokke (ed.), Governing High Seas Fisheries:

possible to assert that the conduct of marine scientific research takes on a new meaning with the emergence of the ecosystem approach.

B. Linkage between Marine Scientific Research and the Precautionary Approach

Furthermore, it is necessary to examine the relationship between marine scientific research and the precautionary approach. The precautionary approach is increasingly reflected in treaties relating to the conservation of marine living resources. Although the definition of the precautionary approach or principle varies depending on the instruments, the essence of this approach is that once a risk has been identified, the lack of scientific proof of cause and effect shall not be used as a reason for not taking action to protect the environment.[72] This does not mean, however, that scientific data becomes unnecessary in the application of this approach. There must be some scientific basis for predicting the possibility of harmful effects before applying the precautionary approach.[73] Hence, adequate marine scientific research is required in order to determine whether or not there is a risk causing serious harms which may trigger the application of the precautionary approach. On this point, EC's Communication on the Precautionary Principle clearly states that:

> "Recourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with sufficient certainty.
>
> The implementation of an approach based on the precautionary principle should start with a scientific evaluation, as complete as possible, and where possible, identifying at each stage the degree of scientific uncertainty."[74]

The Interplay of Global and Regional Regimes, Oxford 2001, 238. In addition, the EC is also a major "client" of the ICES. Concerning interplay between the ICES and the common fishery policy of the EC, see O.S. Stokke/C. Coffey, Precaution, ICES and the Common Fisheries Policy: a Study of Regime Interplay, (2004) 28 Marine Policy, 117-126.

[72] D. Freestone/E. Hey, Origin and Development of the Precautionary Principle, in: D. Freestone/E. Hey (eds.), The Precautionary Principle and International Law: The Challenge of Implementation, The Hague et al. 1996, 13. As a resent study on the precautionary approach in law of the sea, see S. Marr, The Precautionary Principles in the Law of the Sea: Modern Decision Making in International Law, The Hague 2003; D. Vanderzwaag, The Precautionary Principle and Marine Environmental Protection: Slippery Shores, Rough Seas, and Rising Normative Tide, (2002) 33 ODIL, 165-188. With respect to a thorough examination on State practice relating to the precautionary approach, see A. Trouwborst, Evolution and Status of the Precautionary Principle in International Law, The Hague et al. 2002.

[73] P. Birnie/A. Boyle, International Law and the Environment, 2nd ed., Oxford 2002, 117; J. Wettestad, Science, Politics and Institutional Design: The Case of the North-East Atlantic Land-based Pollution Regime, (1994) 18 Marine Policy, 226.

[74] Commission of the European Communities, Communication on the Precautionary Principle, COM (2000), 3, para. 4.

Moreover, the Communication unequivocally states that "[b]efore the precautionary principle is invoked, the scientific data relevant to the risks must first be evaluated".[75] Similarly, in relation to the conservation of marine living resources, the 2000 Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean makes it clear that: "[i]n applying the precautionary approach, the members of the Commission shall: (c) develop data collection and research programmes to assess the impact of fishing on non-target and associated or dependent species and their environment […]."[76] Considering that the precautionary approach may restrict activities by States in the oceans, adequate marine scientific research as well as reliable data are prerequisites in the application of this approach.[77]

On the other hand, it appears that the assessment of scientific data in the application of the precautionary approach is not free from difficulties. In fact, the results of such assessments can be changeable in accordance with the development of scientific technology. In this sense, the interpretation of risk is only relative.[78] Furthermore, the assessment of risk is often difficult to make since such risk is not well known or cannot yet be known at the present-day science. This is an inherent dilemma of the precautionary approach.[79] These uncertainties may produce differences in opinions between scientists or between States. Hence, it is desirable that scientific criteria for the application of the precautionary approach should be formulated within a multilateral framework, such as international scientific institutions, with a view to enhancing objectivity and transparency.[80]

In summary, the above considerations reveal that there exists a close relationship between three elements, that is to say, marine scientific research, the ecosystem approach and precautionary approach.[81] In this sense, it may be said that the impor-

[75] Ibid., 13, para. 5.1.1.

[76] Article 6 (1).

[77] On this point, Birnie states that: "[t]he precautionary approach now required cannot be implemented without maximum scientific knowledge and the gathering, evaluating and dissemination of data", note 28, 250.

[78] P. Martin-Bidou, Le principe de précaution en droit international de l'environnement, (1999) 13 RGDIP, 651.

[79] Ibid., 647.

[80] In this respect, it is notable that ICES continues to develop criteria for the precautionary approach to fisheries management. ICES, The ICES Integrated Action Plan, 2003-2007, 28 October 2002, 5. Furthermore, ICES explicitly agrees that a precautionary approach should be applied to fishery management. Report of the ICES Advisory Committee on Fishery Management, 2002, Part I, p. i. See also O.S. Stokke/C. Coffey, Precaution, ICES and the Common Fisheries Policy: A Study of Regime Interplay, (2004) 28 Marine Policy, 119.

[81] In connection with this, it should be noted that the ecosystem approach and the precautionary approach are closely linked each other. In reality, the whole mechanism of an ecosystem is often difficult to understand. Owing to the scientific uncertainty relating to the mechanisms of marine ecosystems, it is argued that the precautionary approach should be taken in the application of the ecosystem approach. With respect to interrelationship between the ecosystem and precautionary approaches, see Y. Tanaka, Zonal and Integrated Management Approaches to Ocean Governance: Reflections on the Dual Approach in International Law of the Sea, (2004) 19 IJMCL, 500-504; L. Juda, International

tance of international co-operation in marine scientific research is underscored by the emergence of the ecosystem and precautionary approaches.

IV. Conditions to Enhance Effectiveness of the Obligation to Co-operate in Marine Scientific Research

On the other hand, a question arising is how it is possible to enhance the effectiveness of the implementation of the obligation to co-operate in marine scientific research in reality. In this respect, one may point to at least three issues which need further consideration.

A. Specification of Contents of the Obligation

The first issue pertains to the specification of the obligation to co-operate in marine scientific research. A possible criticism concerning the obligation to co-operate in general may be that the contents of this obligation are so vague as not to be very useful. It is undeniable that specific conducts required in fulfilment of the obligation of co-operation are left obscure; and that a breach of such an obligation is difficult to prove.[82] It appears that, to some extent, this criticism may be applicable to the obligation to co-operate in marine scientific research. Hence, further specification of the contents of this obligation becomes important. In this connection, special attention should be drawn to at least two factors: the quality of information as well as the credibility of data assessment.

With respect to the data quality, there are concerns that effective management of marine capture fisheries has been hindered by unreliable information.[83] In this respect, UN General Assembly Resolution of 1997, Programme for the Further Implementation of Agenda 21, calls for Governments "to take actions, individually and through their participation in competent global and regional forums, to improve the quality and quantity of scientific data as a basis for effective decisions related to the protection of the marine environment and the conservation and management of marine living resources".[84] Furthermore, the FAO Committee on Fisheries adopted the FAO Strategy for Improving Information on Status and Trends of Capture Fisheries on 23 February 2003.[85] This FAO Strategy explicitly requires States to enhance their capacities to collect data to ensure that the coverage of fish-

Law and Ocean Use Management: The Evolution of Ocean Governance, London/New York 1996, 289. See also S.B. Kaye, International Fisheries Management, The Hague 2001, 273-274.

[82] Pinto (note 16), 138.

[83] United Nations, Report of the Secretary-General (note 32), 55, para. 215.

[84] UN General Assembly Resolution, A/RES/S-19/2, para. 36 (g).

[85] The text of this Strategy is available at the homepage of FAO <http://www.fao.org/>.

eries information is as complete as possible.[86] Furthermore, the Strategy ensures that States should co-operate through their regional fishery bodies and arrangements to develop and adopt effective and pragmatic standards and systems for data collection, which should be compatible with FAO systems.[87] On the basis of the FAO Strategy, effort should be made to specify a criterion to enhance the quality of marine scientific information.

Moreover, it is important to ensure the credibility of data assessment through international collaboration as much as possible. In reality, the *Southern Bluefin Tuna* case of 1999 between Australia, New Zealand and Japan clearly revealed that the data unilaterally submitted by one party (Japan) could not be accepted by other parties (Australia and New Zealand) producing dispute concerning allocation of southern bluefin tuna.[88] It is therefore important to specify a procedure to assess scientific data in an objective and impartial manner. To this end, the establishment of a research procedure by independent experts may arguably help to enhance the credibility of marine scientific data. In this respect, one may note with interest that, after the Order of 1999 by ITLOS and the Award of 2000 by Arbitral Tribunal, Australia, New Zealand and Japan turned from reliance on their own national scientific advisers to an independent scientific research programme.[89] Thus, at a Special Meeting in November 2000, the Commission for the Conservation of Southern Bluefin Tuna decided that a scientific research program should be developed by the external scientists.[90] At the Sixth Meeting of the Scientific Committee of 2001, the Committee expressed the view that at the time of the most recent round of quota reductions (1988), spawning stock size was well below levels in 1980 and earlier and had declined further since then, with a possible upturn in recent years.[91] Furthermore, the Scientific Committee's Report concluded that at current catch levels there was little chance that the southern bluefin tuna spawning stock biomass would be rebuilt to 1980 levels by 2020, and substantial quota reductions would be required to achieve that goal.[92] Against the background of this scientific guidance, TAC and national allocations were finally agreed at the tenth Annual Meeting in October 2003.[93] This episode appears to show that the establishment of the inde-

[86] Ibid., 6, para. 25.

[87] Ibid., para. 27.

[88] C. Romano, The Peaceful Settlement of International Environmental Disputes: A Pragmatic Approach, The Hague 1999, 216.

[89] T. Stephens, The Limits of International Adjudication in International Environmental Law: Another Perspective on the Southern Bluefin Tuna Case, (2004) 19 IJMCL, 183.

[90] 'Development of a SBT Scientific Research Program including a Scientific Fishing Component by the CCSBT External Scientists' Commission for the Conservation of Southern Bluefin Tuna, Report of the Special Meeting, 16-18 November 2000, para. 32.

[91] Report of the Sixth Meeting of the Scientific Committee, 28-31 August 2001, para. 24.

[92] Ibid., para. 29. See also para. 30.

[93] The agreed quotas were at the same level first established by informal agreement in 1989. Australia 5,265 tonnes; Japan 6,065 tonnes; New Zealand 420 tonnes. Report of the Extended Commission of the Tenth Annual Meeting of the Commission, para. 51. With respect to the negotiation process in the Commission in some detail, see Stephens (note 89), 183-186.

pendent scientific process created one of the important conditions in which the Commission was presented with consistent and credible data for the decision-making on TAC and national allocations.[94] In short, it is argued that a procedure to enhance a credibility of data assessment becomes an important element elaborating international co-operation in marine scientific research.

B. Institutional Mechanisms for the Implementation of the Obligation

The second issue relates to institutional mechanisms ensuring effective implementation of the obligation to co-operate in marine scientific research. It is argued that the obligation of co-operation requires action in good faith with a view to pursuing a common objective.[95] As Pinto has pointed out, co-operative obligation, whether express or implied, undertaken by the parties to an international agreement would be a mere sham, if they were not recognised as being obligations to act.[96] There is no doubt that the obligation of international marine scientific co-operation has a legal basis at the treaty level, and that States Parties to treaties providing this obligation shall implement this obligation in good faith. It follows that *a priori* rejection to act to co-operate in marine scientific research is contrary to the obligation. In this respect, an issue that needs to be examined is how it is possible to ensure the implementation of this obligation.

The 1982 LOSC as well as the 1995 Fish Stocks Agreement do not contain specific institutional mechanisms, merely referring to the co-operation through "competent international organisations" or "subregional or regional organisations." It is presumed that FAO is such a competent international organisation.[97] It is also acknowledged that other specialised UN agencies, such as UNESCO/IOC and UNEP, are also playing an important role for international co-operation of marine scientific research.[98] In this connection, special mention should be made with respect to the role of regional fisheries organisations ensuring international marine

[94] Stephens, ibid., 186. See also B. Mansfield, The Southern Bluefin Tuna Arbitration: Comments on Professor Barbara Kwiatkowska's Article, (2001) 16 IJMCL, 365.

[95] Scovazzi (note 33), 132.

[96] Emphasis original. Pinto (note 16), 145. Dinh, Daillier and Pellet also state that the obligation of co-operation "n'est donc pas un simple principe d'art politique ou un voeu pieux. La jurisprudence internationale peut prendre appui sur lui pour renforcer la portée des engagements de négociation ou de conclusion des accords internationaux." N. Quoc Dinh/P. Daillier/A. Pellet, Droit international public, Paris 1999, 6e ed., 432.

[97] Regarding the activities of FAO on law of the sea, see M.H. Nordquist/J.N. Moore (eds.), Current Fisheries Issues and the Food and Agriculture Organization of the United Nations, The Hague 2000.

[98] The examination on activities of these international organisations beyond the scope of this study because of a limited space. With respect to this issue, see Gorina-Ysern (note 1), 551-562. See also B. Kwiatkowska, The 200 Mile Exclusive Economic Zone in the New Law of the Sea, Dordrecht 1989, 153-154.

scientific co-operation. It is notable that many regional agreements relating to the management of marine living resources seek to enhance marine scientific co-operational through fisheries commissions established in these regional agreements.[99] To this end, principal functions of such commissions can be summarised in four points:

(i) to encourage, promote and co-ordinate scientific research,
(ii) to compile, disseminate and analyse statistical and biological information,
(iii) to oblige parties to submit statistical, and biological data,
(iv) to provide a forum for consultation and exchange of information.

First, a number of regional fisheries commissions are empowered to promote and co-ordinate the conduct of marine scientific research.[100] In this respect, it is worth mentioning that the North Pacific Anadromous Fish Commission requires the Parties to submit to the Commission scientific research programs to be conducted by their nationals or vessels involving fishing for anadromous fish in the Convention Area. The catches of anadromous fish taken in conjunction with any scientific research in the Convention Area should be reported to the Commission within nine months.[101] In so doing, the conduct of marine scientific research is subject to the Commission's control. For this purpose, the Commission established the Committee on Scientific Research and Statistics (CSRS). At the CSRS, as well as at the Research Planning and Co-ordinating Meeting, the Parties discuss scientific research co-operation on the basis of their scientific research plans for salmon, the results of their previous researches as well as statistical data of their catches and

[99] See also Part II D of this study.

[100] Examples may be furnished by the following commissions: Indo-Pacific Fisheries Commission (Article 4 (f) of 1948 Indo-Pacific Fisheries Commission Agreement amended in 1996), General Fisheries Commission for the Mediterranean (Article 3 (1) (e) of the 1949 Agreement for the Establishment of a General Fisheries Commission for the Mediterranean finally amended in 1997), Mixed Commission in the Black Sea (Article 9 (3) of the 1959 Convention Concerning Fishing in the Black Sea), International Baltic Sea Fishery Commission (Article 9 (1) (b) of the 1973 Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and Belts), Scientific Committee of the Commission for the Conservation of Antarctic Marine Living Resources (Article 15 (1) of the 1980 CCAMLR), Scientific Committee of the Eastern Pacific Tuna Fishing Organisation (Article 11 (1) of the 1989 Agreement Creating the Eastern Pacific Tuna Fishing Organisation), Indian Ocean Tuna Commission (Articles 5 (2) (b) and 12 (4) (c) of the 1993 Agreement for the Establishment of the Indian Ocean Tuna Commission), Scientific Committee of the Commission for the Conservation of Southern Bluefin Tuna (Article 9 (2) (b) of the 1993 Convention for the Conservation of Southern Bluefin Tuna), Regional Commission for Fisheries (Article 3 (1) (e) of the 1999 Agreement for the Establishment of the Regional Commission for Fisheries), the Pacific Salmon Commission (Article 10 (2) of the 1999 Treaty between the Government of Canada and the Government of the United States of America Concerning Pacific Salmon), the South-East Atlantic Fisheries Commission (Article 6 (f) of the 2001 Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean).

[101] Article VII (7) of the 1992 Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean.

fry releases.[102] Thus, international collaboration in marine scientific research is being enhanced through these activities of the Commission.

Secondly, regional fisheries bodies are often required to compile, disseminate and analyse relevant information by agreements.[103] For example, the Commission for the Conservation of Antarctic Marine Living Resources is under an obligation to compile data on the status of, and changes in the population of Antarctic marine living resources in accordance with Article 9 (1) (b). In connection with this, the Scientific Committee, which is established as a consultative body to the Commission, is empowered to analyse data concerning the direct and indirect effects of harvesting on the populations of Antarctic marine living resources under Article 15 (2) (c). Furthermore, it is worth noting that some regional commissions are empowered to conduct marine scientific research in their own right. For instance, the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean may engage the services of scientific experts to provide information and advice on the fishery resources covered by this Convention and related matters that may be relevant to the conservation and management of those resources. The scientific experts may, as directed by the Commission, conduct scientific research and analyses in support of the work of the Commission.[104] In carrying out their work, the scientific experts may undertake the collection, compilation and dissemination of fisheries data according to agreed principles and procedures established by the Commission as well as investigate such other scientific matters as may be referred to them by the Commission.[105]

Thirdly, the regular submission of data from the parties becomes essential in order to collect relevant data. Thus, regional agreements often oblige the parties to submit, regularly or on request, any available scientific and statistical information

[102] With respect to science activities of North Pacific Anadromous Fish Commission, see <http://www.npafc.org>.

[103] For instance, such power is provided in the following commissions: the Inter-American Tropical Tuna Commission (Article 2 (2) of the 1949 Convention for the Establishment of an Inter-American Tropical Tuna Commission), the International Commission for the Conservation of Atlantic Tunas (Article 4 (2) (a) of the 1966 International Convention for the Conservation of Atlantic Tunas), the Northwest Atlantic Fisheries Organisation (Article 6 (1) (b) of the 1978 Convention on Future Multilateral Co-operation in the Northwest Atlantic Fisheries), the South Pacific Forum Fisheries Agency (Article 7 (a) of the 1979 South Pacific Forum Fisheries Agency Convention), the Commission for the Conservation of Antarctic marine Living Resources (Articles 9 (1) (b) (d) and 15 (2) (c) of the 1980 CCAMLR), the North Atlantic Salmon Conservation Organisation (Article 12 (2) (b) of the 1982 Convention for the Conservation of Salmon in the North Atlantic Ocean), the North Pacific Anadromous Fish Commission (Article 10 (2) (b) of the 1992 Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean), the Indian Ocean Tuna Commission (Articles 5 (2) (a) and 12 (4) (b) of the 1993 Agreement for the Establishment of the Indian Ocean Tuna Commission).

[104] Article 13 (1) and (2) of the 2000 Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean.

[105] Article 13 (3) (a) and (e) of the 2000 Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean.

to fisheries commissions or associated Scientific Committees.[106] As an example, Article 13 (1) (d) of the Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean of 2001 provides that Each Contracting Party shall "provide annually to the Organisation [South-East Atlantic Fisheries Organisation] such statistical, biological and other data and information as the Commission may require". Such a reporting system can be an appropriate means of promoting the exchange of scientific information by the commissions. On the other hand, it is suggested that many States fail to fulfil the reporting obligation or report superficially to the relevant international institutions.[107] With respect to this problem, a solution may be to specify the content of the reports in detail or providing commitments of Contracting Parties or commissions to information.[108] Finally, there is little doubt that regional fisheries commissions can provide fora for the consultation and exchange of information by undertaking the three functions mentioned above. The above considerations lead to the conclusion that regional fisheries commissions have an important role to play in enhancing international co-operation in marine scientific research.

In connection with this, a question arising is that the proliferation of international institutions may produce problems regarding overlaps of jurisdiction.[109] In fact, co-ordination between relevant international bodies is currently becoming an important issue in international law in general.[110] With respect to the protection of the marine environment, for instance, a concern has already been voiced that collection, analysis and reporting of data is undertaken within overlapping frame-

[106] Such examples contain: Article 9 (2) (a) of the 1966 International Convention for the Conservation of Atlantic Tunas, Article 12 (3) of the 1973 Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and Belts, Article 6 (3) of the 1978 Convention on Future Multilateral Co-operation in the Northwest Atlantic Fisheries, Article 9 (c) of the 1979 South Pacific Forum Fisheries Agency Convention, Article 16 (2) of the 1980 Convention on Future Multilateral Co-operation in North-East Atlantic Fisheries, Article 20 of the 1980 CCAMLR, Article 15 (1) (2) (3) of the 1982 Convention for the Conservation of Salmon in the North Atlantic Ocean, Article 7 (3) of the 1992 Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean, Article 11 (1) of the 1993 Agreement for the Establishment of the Indian Ocean Tuna Commission, Article 10 (2) of the 1994 Convention on the Conservation and Management of Pollock Resources Central Bering Sea, Article 13 (1) (d) of the 2001 Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean.

[107] P. Sand, Principles of International Environmental Law, 2nd ed., Cambridge 2003, 181-182.

[108] Some treaties concerning the protection of the marine environment adopt this solution. See for instance Helsinki Convention (Article 16), and the OSPAR Convention (Articles 9 and 22).

[109] R.R. Churchill, Levels of Implementation of the Law of the Sea Convention: An Overview, in: Vidas/Østreng (note 51), 319.

[110] A. de Marffy, La place des organisations internationales competentes dans la mise en application du régime de la ZEE, in: E. Franckx/P. Gauthier (eds.), The Exclusive Economic Zone and the United Nations Convention on the Law of the Sea, 1982-2000: A Preliminary Assessment of State Practice, Brussels 2003, 52. See also Chapter 17 of the Agenda 21, para. 17.116. Churchill (note 109), 319.

works.[111] In reality, apart from some inter-agency mechanisms, such as the Global Investigations of Pollution in the Marine Environment (GIPME), the Inter-Secretariat Committee on Scientific Programmes Relating to Oceanography (IC-SPRO) and the Joint Group of Experts on Scientific Aspects of Marine Environmental Protection (GESAMP), it appears that there is little consolidation of programme activities or effective policy co-ordination at the global level.[112] The same might be true of marine scientific research relating to the marine living resources. Hence, further consideration will be required with respect to co-ordination of marine scientific activities between relevant international institutions.

C. Scientific and Technical Assistance to Developing States

Finally, but not least, it is necessary to reflect scientific and technical assistance to developing States. Considering that marine scientific facilities in developing countries remain insufficient, the technical and financial assistance to these countries is imperative for promoting marine scientific research.[113] On this point, Annex VI of the Final Act of the 1982 LOSC explicitly stated that "unless urgent measures are taken, the marine scientific and technological gap between the developed and the developing countries will widen further and thus endanger the very foundations of the new régime".[114] Thus, Annex VI urged the industrialised countries to assist the developing countries in the preparation and implementation of their marine science, technology and ocean service development programmes.[115] In this regard, it should be remembered that Article 202 of the 1982 LOSC explicitly enunciates an obligation concerning scientific and technical assistance to developing States in the context of the protection of the marine environment.[116] Similarly, the Code of Conduct also pronounces the need for assistance to developing countries

[111] This concern was voiced in the First Joint Ministerial Meeting of the Helsinki and OSPAR Commissions. Statement on the European Marine Strategy, What HELCOM and OSPAR can Bring to the Development of the European Marine Strategy, Bremen, 25-26 June 2003, para. 3.

[112] L. Hinds, Ocean Governance and the Implementation Gap, (2003) 27 Marine Policy, 351; G. Kullenberg, Global International Organisations and the Implementation of the Law of the Sea Convention, in: Vidas/Østreng (note 51), 351.

[113] Some instruments make it clear an obligation to assist developing States for marine scientific research. See for instance, Articles 202 (a) (v) and 244 (2) of the 1982 LOSC; Articles 12.18, 12.20 of the FAO Code of Conduct; Article 21 (4) (b) of the 2001 Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean; Article 30 (4) of the 2000 Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean.

[114] Preamble of Annex VI, Resolution on Development of National Marine Science, Technology and Ocean Service Infrastructures.

[115] Ibid., para. 3.

[116] Such assistance shall include, *inter alia*: (i) training of their scientific and technical personnel; (ii) facilitating their participation in relevant international programmes; (iii) supplying them with necessary equipment and facilities; (iv) enhancing their capacity to manufacture such equipment; (v) advice on and developing facilities for research, monitoring, educational and other programmes.

in Article 12.18. In particular, Article 12.20 states that "[r]elevant technical and financial international organisations should, upon request, support States in their research efforts, devoting special attention to developing countries, in particular the least-developed among them and small island developing countries". In State practice, Article 21 (4) (b) of the 2001 South-East Atlantic Convention provides the duty of co-operation with developing States in the South Atlantic region concerning stock assessment and scientific research.

In this respect, it is important to note that scientific and technical assistance to developing States is closely linked to the development and transfer of marine scientific technology embodied in Part XIV of 1982 LOSC.[117] This point is clearly reflected in Article 266 (2) of the 1982 LOSC:

> "States shall promote the development of the marine scientific and technological capacity of States which may need and request technical assistance in this field, particularly developing States, including land-locked and geographically disadvantaged States, with regard to the exploration, exploitation, conservation and management of marine resources, the protection and preservation of the marine environment, marine scientific research and other activities in the marine environment compatible with this Convention, with a view to accelerating the social and economic development of the developing States."

It is argued that this provision establishes objectives more than rules. Even so, it should be stressed that these objectives reflect the philosophy of the 1982 LOSC concerning "a just and equitable international economic order which takes into account the interests and needs of mankind as a whole and, in particular, the special interests and needs of developing countries".[118] In this sense, it may be said that the enhancement of international co-operation in marine scientific research closely concerns the fundamental goal of the 1982 LOSC.

V. Conclusions

The above considerations can be summarised in four points.

1) Reflecting the increasing importance of marine scientific research in the conservation of marine living resources, currently there is a clear trend that the obligation to co-operate in marine scientific research is provided in treaties on this matter at the global and regional levels. At the global level, this obligation is explicitly reflected in the 1982 LOSC, the 1995 FAO Code of Conduct, as well as the 1995 Fish Stocks Agreement. At the regional level, the need for international scientific co-operation is increasingly accepted in the conservation of various species as well as in various regions. In this respect, it is worthy of note that some treaties provide

[117] Jarmache (note 1), 309. Furthermore, as provided in Article 268, the development of human resources through training and education of nationals of developing States is also important. To this end, the IMO has established two educational organs: the World Maritime University (1983) and the IMO International Maritime Law Institute (1989).

[118] Preamble. See Virginia Commentary, Vol. IV, (note 17), 677.

a dual obligation relating to marine scientific research, that is to say, an obligation on each State to conduct of marine scientific research and obligation to co-operate in marine scientific research between States. Considering that sufficient and credible scientific data is a prerequisite for the conservation of marine living resources, it is arguable that the dual obligation is of central importance in this matter.

2) The emergence of the obligation to co-operate in marine scientific research is not an isolated phenomenon, but is closely linked to the new approaches to the conservation of marine living resources: the ecosystem and precautionary approaches. In applying the ecosystem approach, considerable studies will be needed with a view to investigating marine ecosystems. Such studies will necessitate international scientific co-operation owing to the transboundary nature of marine ecosystems. Furthermore, marine scientific research is also required in order to determine the existence of serious harms which may trigger the application of the precautionary approach. As the application of the precautionary approach may restrict States' activities in the oceans, adequate marine scientific research before applying this approach is particularly important. It would seem to follow that the conduct of marine scientific research is a prerequisite for the application of two key approaches in the conservation of marine living resources.

3) On the other hand, at least three conditions should be fulfilled to effectively implement the obligation to co-operate in marine scientific research:

(i) further specification of the contents of the obligation, including the enhancement of the quality of information as well as the credibility of data assessment,

(ii) establishment of institutional mechanisms ensuring the implementation of this obligation, and

(iii) scientific and technical assistance to developing countries.

With respect to the first issue, it is necessary to elaborate a criterion enhancing the quality of scientific data as required by the 2003 FAO Strategy. Furthermore, it would seem that the establishment of the independent scientific process may be useful to enhance a credibility of data assessment. Concerning the second issue, it is notable that specialised UN agencies as well as regional fisheries commissions have a primordial role to play. In relation to the third point, it needs to be stressed that the scientific and technical assistance to developing countries is particularly important to achieve an objective of the 1982 LOSC realising "a just and equitable international economic order" which takes into account the special interests and needs of developing countries.

4) Finally, the above survey appears to show that interplay between law and science is increasingly important in the international law of the sea. As the ocean is a dynamic natural system, it is arguable that the law of the sea must take the dynamics of nature into account. It would seem, however, that the law has not yet sufficiently considered the fluid and dynamic nature of the ocean. Thus, further consideration will be required with respect to the growing interaction of law and marine science. This issue will highlight a need for an interdisciplinary approach in the law

of the sea. In this sense, close co-operation between lawyers and scientists will be further required in the conservation of marine living resources.[119]

[119] The same is true of the protection of the marine environment.