PART 1: REPORT OF THE EXPERT CONSULTATION ON DEEP-SEA FISHERIES IN THE HIGH SEAS

OVERVIEW OF THE MEETING AND ARRANGEMENTS FOR THE SESSION

1. The Expert Consultation on Deep-sea Fisheries in the High Seas was held in Bangkok, Thailand, from 21 to 23 November, 2006. The Consultation was attended by 17 experts from a wide range of disciplines, experience and geographic areas. The participants are listed in Appendix C.

2. The opening statement was delivered by Mr He Changchui, Assistant Director-General and Regional Representative for Asia and the Pacific. Mr. Changchui emphasized the increasing importance of addressing concerns in the deep seas. He mentioned the importance of the topic to Member Nations and the recognition that the current management regime has proven inadequate. The welcoming address is given in Appendix B.

3. Dr Dominique Gréboval and Dr Ross Shotton, co-conveners of the meeting, called the Expert Consultation to order and introduced the meeting and agenda.

4. Changes were made to the agenda based on information provided by late arriving participants and additional presentations that were made available. The new agenda was then adopted by all participants (Appendix A).

5. Dr John Kalish, General Manager, International Fisheries and Aquaculture, Department of Agriculture, Fisheries and Forestry, Australia was elected Chairperson.

OVERVIEW OF MANAGEMENT ISSUES

6. Dr Pamela M. Mace, Chief Scientist, Ministry of Fisheries, New Zealand, presented the initial background document entitled "Can deepwater fisheries be managed sustainably?" She mentioned the lack of agreement as to what constitute deep-sea fisheries. Two species are dominant in the reported catch, blue whiting and hairtails, but these species are mostly nearshore and only extend to about 300 m. True deepwater species, such as orange roughy, make up a much smaller portion of the global catch. Deepwater fisheries experience the same problems as shallow water species but with some exacerbation. Particular challenges to deepwater fisheries science include stock, habitat and biodiversity assessments. Dr Mace presented a case study for the New Zealand orange roughy fishery that described the management difficulties encountered. In conclusion, she emphasized the need for less ambiguous terminology for deep-sea fisheries, the separation of data from fisheries within and outside of exclusive economic zones (EEZs), the need to distinguish highly productive deepwater species and the less productive deepwater species to establish better management regimes, and the importance of using a highly precautionary and ecosystem-based approach.

7. **Summary of paper presented:** Governance of deepwater fisheries has a high profile in the international community, including the explicit attention of the United Nations General Assembly (UNGA). This attention reflects concerns about the sustainability of deepwater fisheries and the fragility of deepwater ecosystems, and concern that the international fisheries governance framework does not adequately address issues of deepwater fisheries on the high seas.

8. Deepwater fisheries have been considered by FAO as those fisheries that occur beyond the continental shelf/slope break which typically occurs at about 200 meters (m). The current technological limit of these fisheries is about 2 000 m. However, many species not usually considered as deepwater are fished at depths well below 200 m (e.g. the North Pacific walleye pollock fishery, one of the world's most productive, occurs over the depth range of 90–500 m). According to the FAO statistical database, deepwater fisheries produced 5.9 million tonnes (t) in 2004 or less than four percent of the total production from fisheries and aquaculture (including freshwater). Most of this

catch is of species that generally occur in depths less than 500 m. Some of the species that account for much of the catch occur in shallow nearshore waters as well as below 200 m in depth.

9. Deepwater fisheries should not all be "painted with the same brush" (or, in other words, hairtails and blue whiting are not the same "kettle of fish" as orange roughy and oreo dories) as there is a great deal of difference between the species fished in the shallow end of the range of deepwater fisheries and those fished at depths centered below 500 m. Species fished in the shallow end of the range have similar biological characteristics to shelf species. They are productive compared to some deeper-water species, such as orange roughy. The discourse on deepwater fisheries would be well served by a common understanding of what constitutes a deepwater fishery and what makes them different from other fisheries.

10. Deepwater fisheries beyond 500 m generally have a history of less than three decades, during which early expectations of the sustainable yields have often been too optimistic. As a result, the biomass on many fishing grounds has been depleted, and biogenic habitats have been impacted. The deepwater fisheries that have attracted the most attention are those for orange roughy, which occur at depths of 800 m and below. Simply stated, the global track record for sustainable management of deepwater fisheries beyond 500 m is not good. Deepwater fisheries have been unsustainable for one or more of the following fundamental reasons:

- they have remained largely unregulated;
- initial scientific assessments have been too optimistic; and/or
- management has not responded to, or has been slow to respond to, scientific advice calling for improved conservation.

11. This experience clearly points to the need to strictly adhere to the precautionary approach and apply an ecosystem approach. More specifically:

- all deepwater fisheries should be authorized with constraints set cautiously, and new fisheries should have a development plan that assures that the rate of development is consistent with the gathering of knowledge;
- management strategies for deepwater fisheries need to be re-examined in light of the poor track record to date; in particular biological reference points should be set more conservatively and explicit "fishing down" phases should be avoided;
- steps need to be taken to address habitat and biodiversity effects of deepwater fisheries;
- research is needed to improve resource assessments, knowledge about the distribution of resources off fishing grounds, understanding stock structure, and understanding the functional value and vulnerability of habitat and biodiversity;
- new multilateral arrangements are needed to manage high seas fisheries in some areas, although individual nations could prevent overfishing on the high seas if they consistently applied the FAO Code of Conduct for Responsible Fisheries and the UN Compliance Agreement; and
- there is a need to improve compliance with fishery conservation measures and reporting of fishery dependent data. Catch documentation schemes, such as the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) scheme used to reduce illegal, unreported and unregulated (IUU) fishing of toothfish, should be extended to all fish that enter into international trade.

12. An unanswered question is whether the benefit–cost ratio for deepwater fisheries for long-lived, low-productivity species will remain positive if the full costs for research and management, as characterized above, are taken into account?

OVERVIEW OF LEGAL AND INSTITUTIONAL ISSUES

13. Dr Erik J. Molenaar, Senior Research Associate, Netherlands Institute for the Law of the Sea reviewed the relevant global instruments and institutions for deepwater fisheries, as well as the current situation regarding regional fisheries management organizations (RFMOs) and other arrangements. He noted the need for reform of existing RFMOs to expand their mandates, and the need for further coverage of discrete high-seas fish stocks, particularly where no arrangement exists to date. Potential reforms at the global level might include an implementation agreement to the United Nations Convention on the Law of the Sea (UNCLOS). The FAO is also in a position to offer non-binding guidance in a variety of forms.

14. **Summary of paper presented:** This report analysed the current regional and global legal and institutional framework relating to the conservation and management of high-seas deep-sea species and fisheries, identified their gaps and shortcomings and offered a range of solutions.

15. The objectives and species coverage of the constitutive instruments of various relevant RFMOs and Arrangements indicate that (part of) the UN Fish Stocks Agreement is already applicable to discrete high-seas fish stocks. Even though state practice "merely" consists of the texts of constitutive instruments, there seem to be no scientific, pragmatic or other factors apart from the issue of the allocation of fishing opportunities, that would necessitate RFMOs and Arrangements to explicitly or implicitly distinguish between straddling and discrete high seas fish stocks in performing their functions.

16. There is a need to establish new RFMOs or Arrangements with competence to manage deep-sea species and fisheries. While negotiations to establish these in the Southern Pacific and the North-West Pacific are already underway, there are currently no RFMOs or Arrangements for the Central Atlantic, the South-West Atlantic, the Central Pacific, the North-East Pacific and for areas of the Arctic. The constitutive instruments of these RFMOs or Arrangements should relate to straddling fish stocks as well as to discrete high-seas fish stocks and should be consistent with the Fish Stocks Agreement and other rules of international law, and in particular the Precautionary and the Ecosystem Approaches to fisheries. Where appropriate and necessary, bodies dedicated to deep-sea species and fisheries should be established. Existing RFMOs and Arrangements should be reformed to achieve a similar result.

17. One of the most prominent gaps at the global level is the non-applicability of the UN Fish Stocks Agreement to discrete high-seas fish stocks. Other relevant shortcomings relate to the regime for sedentary species, both on the continental shelves of coastal States and on the seabed beyond the limits of national jurisdiction (the Area). The report examines the advantages and disadvantages as well as the types of instruments (i.e. legally binding and non-legally binding) that could be developed to address these shortcomings.

18. The FAO Committee on Fisheries (COFI) already agreed in 2005 on the need for non-legally binding guidance by FAO on the conservation and management of deep-sea species and fisheries, presumably in the form of Technical Guidelines. However, in view of the possible urgency of the matter, FAO Members may want to also consider developing an international plan of action (IPOA), a Model Arrangement or a legally-binding instrument (whether or not developed within FAO).

OVERVIEW OF ISSUES RELATING TO HIGH SEAS MARINE PROTECTED AREAS

19. Kristina M. Gjerde, High Seas Policy Advisor, IUCN Global Marine Programme, presented the third background paper entitled "High seas marine protected areas and deep-sea fishing." Ms Gjerde highlighted the lessons learned from coastal protected areas and the need to apply those lessons to the deep seas. She underlined the importance of the application of both an ecosystem approach and the precautionary principle based on the vast gaps in knowledge and vulnerability associated with deep-sea ecosystems. The importance of further research and identification of vulnerable marine

ecosystems, stressed by Ms Gjerde, was discussed by the participants. In conclusion, she suggested that (a) MPAs can be a valuable tool for resource protection and recovery, (b) it is important to consider the importance of biodiversity, (c) there is a need to protect spawning aggregations and spawning grounds, and the use of the full range of tools available is necessary, and (d) there is a need to improve information on spatial monitoring and catch documentation. Discussion revolved around the difficulties in assessing and identifying destructive fishing practices and the need to use many tools in managing deep-sea fisheries that should be contingent on stated objectives or identified issues.

20. **Summary of paper presented**: Experiences in coastal and offshore waters under national jurisdiction have shown marine protected areas (MPAs) to be an important component of ecosystem-based oceans and fisheries management. Spatial and temporal closures established as a fisheries management tool can be considered as a subset of MPAs when they enhance protection of biodiversity as opposed to just target species. Properly designed and managed MPAs can be a valuable tool for protection, recovery and maintenance of fish stocks, population size distribution, trophic complexity, ecosystem resilience, habitat structure, biological diversity as well as species' feeding, breeding, spawning and nursery grounds. MPAs would be most effective when human activities, including fishing, are controlled in the context of effective ecosystem-based management.

21. Governments at the World Summit on Sustainable Development set a target of 2012 for the development of representative networks of MPAs, consistent with international law and based on scientific information. The United Nations, the Parties to Convention on Biological Diversity, the FAO Committee on Fisheries and the Review Conference for the Fish Stocks Agreement have called for greater use of MPAs in fisheries management. Efforts are now underway to develop agreed criteria and biogeographic classification systems for representative MPA networks. At the regional level, there are active programs for developing MPAs in areas beyond national jurisdiction in the Northeast Atlantic, the Mediterranean and the Southern Ocean. Several RFMOs have also recently closed areas to protect seamounts or coldwater corals or to prevent deep-sea fisheries from expanding into new or deeper waters. More comprehensively, CCAMLR uses rules on new and exploratory fisheries to control and restrict fisheries in the absence of adequate data and is starting work towards a system of MPAs.

22. In taking measures including MPAs to protect deep-sea biodiversity, it will be important to account for the heightened susceptibility of many deep-sea species to rapid depletion and their associated habitats to damage. Most deep-sea habitats will be very slow to recover, and their degradation is expected to result in reduced abundance and diversity of fish and other species. Despite the absence of data on many aspects of deep-sea ecosystems, it is now possible to identify important species and/or habitats of concern. Predictive modelling can aid in identifying the spatial distribution of important features, such as stony corals. Data already available for some areas of the deep seas include: historic and current bycatch data; bathymetry from bottom swath mapping; oceanographic monitoring (e.g. current drifters, etc.), satellite/remote sensing and data from other national research programs.

23. Several major governance and legal issues at the global and regional levels deserve attention as they could hinder the effectiveness of MPAs as a deep-sea fisheries management tool. These include:

- substantive and implementation gaps in the regime in UNCLOS and the CBD for protection of marine biodiversity in areas beyond national jurisdiction including the establishment of MPAs by non-fisheries bodies;
- the adequacy of RFMO coverage, competence and consistency – in particular the current lack of competent RFMOs in 75 percent of the high seas;
- and the varying rates of implementation of ecosystem-based and precautionary management measures by those that have the legal competence.

24. The lack of a binding global agreement such as the UN Fish Stocks Agreement for discrete deep-seas fish stocks means that while governments may have agreed to apply the UNFSA conservation provisions, the UNFSA's governance and dispute resolution rules are non-binding and there is no formal mechanism to review effectiveness of management.

25. In developing plans for MPAs with respect to deep-sea fisheries on the high seas, elements worth consideration include: developing transparent and science-based criteria for identifying areas appropriate for fishing and vulnerable marine ecosystems; escalating rules and research so that information and understanding precedes exploitation, contributes to developing representative systems of MPAs; and establishing finer-scale management and reporting to identify what and where has been fished and what and where can be protected.

OVERVIEW OF RESOURCES AND FISHERIES

26. Dave Japp, Fisheries & Oceanographic Support Services cc, CapFish cc, presented a background document entitled "Deep-sea resources and fisheries". The lack of a clear definition of deep-seas was also noted by Mr. Japp. He discussed the movement of fisheries from the continental shelves out towards the high seas and stressed that technology, though an important facilitator of this change, is not the most significant factor. Japp highlighted important gaps in the deep-sea fisheries information and noted that many deep-sea fishery issues of the high seas are an extension of those within EEZs, the lack of an adequate definition and the need for a larger focus on the most vulnerable species.

27. **Summary of paper presented:** A global overview of deep-sea fisheries was discussed with the primary aim of stimulating discussion around the major issues associated with the exploitation of deep-sea marine resources. This review primarily focused on "demersal" resources, i.e. fishes found on or near the sea bed (benthic and benthopelagic) with emphasis on cartilaginous (Chondrichthyes) and bony fishes (Osteichthyes). It was noted that the perception of what is "deep" has changed over time with the systematic increase in the depths fished so that coastal offshore fisheries merged with high-seas deep-sea fisheries. One reason for this was the systematic depletion of once abundant shelf stocks and the subsequent search for alternative resources in deeper waters.

28. The successful development of a deep-sea high-seas fishery requires at least three conditions: (a) a viable resource, (b) appropriate technology and information to exploit the resources and (c) a positive benefit-to-cost ratio. Historical deep-sea fisheries exploitation can be broadly separated into two periods. In the pre-1980 period international high-seas deep-sea fishing fleets were first established using existing technology when markets for deep-sea species were underdeveloped and effort was mostly exploratory. Though deepwater stocks in this period were abundant, technology was limited but functional, and the economics were driven by catch volume, relatively low fuel costs and cheap crews. Catch and effort data for this period are lacking, which has made knowledge of the extent of stock depletion and present-day assessments problematic.

29. Since 1980, fishing techniques and technology have advanced enormously and specific markets have developed for deep-sea species. A good example of this is the development of the orange roughy fishery off Australia and New Zealand. Although effort and technology are important factors, economics and market demand are the main drivers of deep-sea fisheries. Technology provides the tools to catch efficiently, but ultimately distance offshore, catch rates and fuel costs dictate deep-sea (high seas) fishing effort. Efficient utilization of sophisticated deep-sea equipment requires a high level of skill and the use of advanced acoustic equipment, global positioning systems and multi-beam sounders. Vessel winch power, rather than vessel size, is important and most modern vessels are smaller and more fuel-efficient than older high seas vessels.

30. Deep-sea trawling operators are being pressured to reduce their impacts on habitat and biodiversity. These issues are complicated by the high degree of variability in the deep-sea environment. Current deepwater regimes, for example, influence the distribution of many deepwater

species and advances in fishing technologies and the efficiency of fishing gear have reduced refuges for many target species through habitat destruction. The innovative use of technology, which might include *in situ,* analytical, and laboratory studies, is likely to reveal much about deep-sea species and ecosystems and the appropriate use of this technology may facilitate the evaluation of the effects of environmental variability on fisheries. Internationally there are initiatives to manage ecosystems rather than focusing on single target species management. One of the ecosystem approaches gaining favour is the creation of marine protected areas (MPAs) that can be both a fisheries management and biodiversity conservation tool.

31. Understanding the biology and behaviour of the many different species exploited in the deep-sea environment is a basic requirement for good resource management and in some deep-sea fisheries (such as for orange roughy) there is good biological information. However, there are still large gaps in our understanding of deep-sea ecosystems as well as the biology and dynamics of the many species found there. Slow growth and low productivity are typical characteristics of deep-sea fish species that make them vulnerable to over-fishing. *Squalid* sharks, orange roughy and grenadiers are, for example, classified as biologically vulnerable while others such as scabbardfish and ling are less so.

32. The dominant exploited deep-sea group is the Gadiformes. These can be split between Gadidae (cods, whiting, saithe, pollack, hake and hoki, etc.), Merluccidae (hakes) and Macrouridea (grenadiers). In terms of reported landings, Gadiformes are second only to the Trichuridae, which comprise mostly frostfish, hairtails, cutlass fish and many other similar species that are either bathy or meso-pelagic. The Trichuridae are caught in large numbers in different oceans using predominantly mid-water trawl gear. Gadiformes, however, are the most highly valued species. The Beryciformes comprise the most definitive commercial deepwater species and include orange roughy (Trachichthyidae) and alfonsino (*Beryx* sp.). Orange roughy catches were first reported from the late 1970s and alfonsino about 10 years earlier: these were targeted by the Russian exploratory high seas vessels. Orange roughy catches peaked around 1990 and have declined wherever they have been exploited. In many fishing areas, particularly seamounts, orange roughy fisheries are often mixed with significant quantities of deep water dories (Zeidae), deep-sea cods and hairtails.

33. Deepwater dories are commonly group caught in deep-sea fisheries and are mostly a bycatch in orange roughy fisheries. Scabbard fish (Perciformes – Trichuridae) catches worldwide are substantial and are caught mostly in mid-water or off-bottom, in relatively shallow and deepwater areas both on and off continental shelves. The global catch of this group has increased since mid-1990 and is now over 1.5 million tonnes a year. Other commercially important deep sea Trichurids are targeted by longliners and include oilfish (*Ruvettus pretiosus*) and the Escolar (Trichuridae). Other minor Perciforme species targeted in deep waters include wreckfish (Polyprionidae), boarfish and cardinals (*Epigonis* sp.). Catches of armourhead (boarfish) have declined in the last decade but are still sporadically targeted, mostly in the Pacific and north Atlantic oceans.

34. The Lophiformes (deep-sea anglers) and cusk eels (Ophididae) have been increasingly targeted in the last decade. The Scorpaeniformes are a commonly caught deepwater species, although catch volumes are comparatively small. Sablefish are an important fishery on the west coast of North America and blue rock fish (*Helicolenus dactylopterus*) are caught extensively on hard grounds by trawl and longline in all oceans. Globally, catches of deepwater rock fishes are declining. Deep-sea chondrichthyans comprise mostly deepwater dogsharks (Squalidae*)*, Chimaeriformes and skates and rays (Rajiformes). These species have low market value and reported catches are low. This may not be a true reflection of the fishing mortality of these species as historically they have been discarded and misreported in most fisheries. Chondrichtyans make up a significant component of deep-sea biodiversity with numerous species classified as critically endangered or vulnerable.

35. Decadal trends by oceanic region suggest that in the Eastern Pacific catches are dominated by gadiformes, more specifically pollock, cod, hakes and grenadiers. Catches peaked at 20 million tonnes in the last 10 years and have started to slowly decline. In the Southeast Pacific the dominant gadoid is hake and catch volumes are increasing, although catches in this region are significantly lower than the

total deep-sea fish mortality in the Northeast Pacific. In the Central Eastern Pacific catch volumes are even lower than in the temperate regions with rock fishes dominating. In the North Western Pacific decadal catches are nearly double that reported for the Northeast Pacific and are dominated by pollock and cod with hairtails being a large proportion to the catch. The trend in catches in this region is a sharp decline over the last 10 years from a peak of about 50 million tonnes to less than 38 million tonnes. As in the Eastern Central Pacific, catches in the Western Central Pacific are dominated by scabbardfish and hairtails. The catch trend in this region is strongly upward over the last decade. Total catches are much lower than in the more temperate northern and southern oceanic regions (approximating 500 000 t). The Southwest Pacific is the most diversified of all the deep-sea areas. Total catch of deep-sea species in the last decade increased marginally to just over 4 million tonnes and consisted mostly of hoki with smaller volumes of orange roughy, alfonsino, oreo dories and other deepwater-directed bycatch species. As in other oceanic regions the data suggest that volumes taken in the northern oceanic regions are substantially higher than in the southern oceans.

36. Historically, in the Northwest Atlantic, catches were as high as in the North East Pacific, with similar species targeted (cods, pollock, hakes) together with relatively small amounts of scorpaenids. Catches of deep-sea species in this oceanic region have declined steadily in the last three decades, (primarily associated with the collapse of the cod fishery). Catch volumes in the Western Central Atlantic are comparatively low (100 000 t in 10 years) but have nevertheless increased significantly in the last decade, consisting predominantly of scabbardfish.

37. The Indian Ocean is covered by two reporting areas, Western Indian and Eastern Indian. In both areas deep-sea catches are dominated by hairtails. Only relatively small proportions of grenadiers, orange roughy and alfonsino are reported.

38. In the Northeast Atlantic the total deep-sea catch has been sustained in the last decades at nearly 38 million tonnes. Species targeted are similar to the Northeast Pacific (cods, pollack, whiting and hake). In the Central Eastern Atlantic the species targeted differ somewhat to the species in the Central Pacific with a higher proportion of hake and whiting although catches are still dominated by scabbard. Total catch in the last decade has declined although at about 700 000 t, it is comparatively lower than both the northern and southern temperate water deep-sea catch estimates. Hake dominates the catches in the South (west and east) Atlantic. In the South West, however, catches have increased since the 1970s and in the last decade approximated 7 million tonnes. The catch trend in the South East Atlantic is declining. At present the South East Atlantic decadal catch approximates 3 million tonnes, predominantly hakes, and peaked at 7 million tonnes in the previous decade.

39. In summary, catch volumes of deep-sea species are significantly higher in the northern temperate water oceans (comprising of predominantly gadoids) than in the southern oceanic areas. In contrast, the southern oceanic regions catches have been dominated by hakes. Although the species diversity of deep-sea resources appears similar in most oceans, reported commercial catches in the southern oceanic regions suggest a greater diversity of fishing activity and species targeted. Stocks in the southern oceanic regions also show less indication of stock stress with both lower volumes being taken and generally fewer downward trends in the last decade. In the central oceanic regions, deep-sea catches are significantly lower than in the temperate seas and are dominated by large amounts of hairtails and scabbard fishes. In the tropical high seas areas, data suggest that in the last decade there has been a shift away from targeting species such as the scorpaenids to targeting scabbardfish and hairtails.

40. These observations suggest that not only is there a disparity between northern and southern hemisphere historical fishing effort, but that there is possibly also a fundamental difference in fishery regimes with possibly higher productivity in the northern oceans.

COMPLEMENTARY PRESENTATIONS AND DOCUMENTS

41. The document entitled, “Inventory of high seas deepwater resources and fisheries”, by A. Bensch, Fisheries Information Officer, FAO, was made available to participants. Mr Bensch describes the two main FAO initiatives' methodologies – Strategy-STF and FishCode-STF – for inventory of marine resources. He determined that the FAO methodologies do indeed offer a valuable framework for the inventory of high seas marine resources. The document is presented in Annex I.

42. Graham Patchell, Sealord Group and Southern Indian Ocean Deepwater Fishers' Association (SIODFA), presented a case study from the Indian Ocean entitled “Sustainable deepwater fisheries, an example of the Southwest Indian Ocean.” The full presentation can be found in Annex II. Mr Patchell discussed the need to “think about the footprint of the fishery, where adverse impacts exist and how to avoid, remedy, or mitigate those impacts” rather than just closing down entire fisheries. He presented the specific case of the Indian Ocean Fishery and explained the current state of the fisheries as well as measures taken by the major trawling companies in that area. SIODFA members have agreed to create benthic protected areas (BPAs) which protect benthic habitats and biodiversity by prohibiting trawling and dredging in prescribed areas.

43. François Simard, Marine Programme Coordinator, IUCN Center for Mediterranean Cooperation, presented a case study entitled “Conservation of the Mediterranean Deep-sea Ecosystems”. The full presentation can be found in Annex III. Mr. Simard described the unique aspects of the Mediterranean ecosystems, such as the high constant temperature (12 ºC) and the large area of high seas due to non-declaration of EEZs by riparian countries. He also discussed a study on the deep-sea ecosystems of the Mediterranean and the resulting proposals. One proposal lead to the closure of areas below 1 000 m to fishing as a precautionary measure. Another proposal focuses on the creation of a network of MPAs to protect unique deep-sea habitats.

CONCLUSIONS AND RECOMMENDATIONS

STATEMENT OF THE PROBLEM

44. The Expert Consultation *took note* of the work undertaken in the context of DEEP SEA 2003, an International Conference on Governance and Management of Deep-sea Fisheries (FAO, 2005a and Shotton, 2005 (a,b)) and subsequent consideration of these matters at the twenty-sixth Committee on Fisheries (COFI) in 2005.[1] COFI agreed that further actions should be taken to address concerns regarding deep-sea fisheries. These actions included:

a) collection and collation of information concerning past and present deepwater fishing activities;
b) undertaking an inventory of deepwater stocks and assessment of the effects of fishing on deepwater fish populations and their ecosystems;
c) convening technical meetings to develop a code of practice/technical guidelines; and
d) reviewing the legal framework needed to support conservation and management of deep-sea fisheries.

45. The Expert Consultation *recognized* recommendations from the United Nations General Assembly (UNGA) resolutions (UNGA Resolution A/RES/59/25 (2005) and UNGA Resolution A/RES/60/31 (2006)) and the urgent need to develop and implement management regimes for deep-sea fisheries.

46. The Expert Consultation *recognized* the trend in many regions for fisheries to expand from coastal waters into deeper waters, in both Exclusive Economic Zones (EEZs) and on the high seas. These movements are linked to the development of improved technologies, depletion of coastal resources, overcapacity in fisheries within EEZs and the freedom to fish for these resources on the high seas.

47. The Expert Consultation *considered* deep-sea fisheries to be those fisheries that are centred at depths below 200 metres. These fisheries are carried out with a range of gear types and in a range of habitats and affect species with diverse life histories/productivities. For the purposes of systematically addressing management issues for deep-sea fisheries, the Expert Consultation *recognized* the need for further classifying deep-sea fisheries on the basis of their biological characteristics (See Annex II and III for an indicative example).

48. The Expert Consultation *recognized* that in recent years there has been rapid development of deep-sea fisheries and that, in many cases, this development has not been sustainable in relation to the target stocks. The Expert Consultation *expressed particular concern* regarding the management of fisheries, both target and bycatch, that have very low productivity such as orange roughy, oreos, deepwater sharks and coldwater corals.

49. The Expert Consultation *recognized* that the impacts of deep-sea fishing should be addressed in relation to target species, bycatch species, habitats and biodiversity.

50. Damage to marine ecosystems has also been noted. The Expert Consultation *stressed* the need for caution before further expansion of these fisheries takes place, particularly in areas on the high seas that are not under the jurisdiction of a regional fisheries management organization or arrangement (RFMO/A). The Expert Consultation *noted* that although some of these resources were "protected" to some extent due to the high cost of fishing, economic factors do not necessarily afford these resources any long-term protection, particularly when high-seas fishing is subsidized by governments.

[1] FAO. 2005. Report of the twenty-sixth session of the Committee on Fisheries.. Rome, 7-11 March 2005. *FAO Fisheries Report*. No. 780. Rome, FAO. 88p. (paragraphs 83-95)

51. Technological developments such as side-scan sonar, swath mapping and satellite altimetry data enable deep-sea fishing fleets to locate and exploit resources that were previously inaccessible. These developments have also worked to overcome some of the economic constraints that have made harvesting of these resources unprofitable.

52. The Expert Consultation *recognized* that there are severe information gaps in relation to deep-sea fisheries on the high seas. These gaps are for both historical and current fishing activity and, as a result, quantitative assessment of these resources is extremely difficult. Problems with assessment are further exacerbated by the poor level of knowledge of the biology for deepwater species, their associated ecosystems and the impact of environmental factors.

53. The Expert Consultation *recognized* that many of the problems associated with the conservation and management of deep-sea fisheries are common to the management of coastal fisheries. Nevertheless the Expert Consultation *identified* four main characteristics that make the management of deep-sea fisheries on the high seas particularly problematic: the vulnerability of low productivity stocks, the vulnerability of the habitats, gaps in international legal regimes for the management of high-seas fisheries and insufficient coverage by monitoring, control and surveillance (MCS) systems.

54. The Expert Consultation *recognized* that even short-term deep-sea fishing can result in significant impacts on the target species, bycatch and habitats. This further highlights the need for urgent management action. In particular, experience in management of low productivity deep-sea fisheries has demonstrated that effective regulation is extremely difficult and traditional approaches to assessment and management may fail to prevent resource depletion and habitat destruction.

55. The Expert Consultation *recognized* the need to fill the governance gap in the international legal framework and institutional arrangements for the conservation and management of deep-sea fisheries. The difficulty in implementing effective management without appropriate governance structures and systems for MCS was also noted.

56. The Expert Consultation *recognized* the relevance of the 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 (UNFSA) and the need to apply its principles and relevant provisions to the management of discrete high-seas fish stocks. The Expert Consultation also *recognized* the relevance of other international instruments including the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (Compliance Agreement), the 1995 Food and Agriculture Organization of the United Nations' (FAO) Code of Conduct for Responsible Fisheries (CCRF), International Plans of Action (IPOAs) in particular the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA–IUU) and the International Plan of Action for the Management of Fishing Capacity (IPOA–Capacity).

57. The Expert Consultation *recognized* that urgent action was required to mitigate further serious impacts to deep-sea resources and habitats including implementation of interim measures. The Expert Consultation *recognized* the merits of actions being undertaken by some States and Regional Fisheries Management Organizations (RFMOs), including the precautionary approach employed by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)[2] and the area closures adopted by the General Fisheries Commission for the Mediterranean (GFCM), Northwest Atlantic Fisheries Organization (NAFO), North East Atlantic Fisheries Commission (NEAFC) and South East Atlantic Fisheries Organisation (SEAFO). The actions taken to create benthic protected areas by the Southern Indian Ocean Deepwater Fishers' Association (SIODFA) were also noted.

[2] The illustrative regulatory framework for fisheries presented in Annex I is mainly based on the CCAMLR example.

58. The Expert Consultation, while focusing on high-seas fisheries, *recognized* that fisheries for the same species also often occur within EEZs and that, as indicated in the UNFSA, there was a need to ensure compatibility among management arrangements.

CONSERVATION OBJECTIVES

59. The Expert Consultation *noted* that the basic objectives for the conservation and management of deep-sea fisheries should reflect the principles, objectives and obligations for the responsible management of fisheries, generally, and the conservation and protection of marine biodiversity. The latter are established through international instruments including: United Nations Convention on Law of the Sea of 10 December 1982 (UNCLOS), the UNFSA, the Compliance Agreement, the CCRF and the Convention on Biological Diversity (CBD). These instruments contain management objectives to address four categories of impacts relevant to the conservation and management of deep-sea fisheries:

a) impacts on target species;
b) impacts on bycatch species, both retained and discarded;
c) impacts on habitats such as coldwater corals and seamounts; and
d) broader food web/trophodynamic impacts on deep-sea ecosystems.

60. Among the key principles and objectives in these instruments the Expert Consultation *considered* the following (paragraphs 61-65)[3]:

61. The management of deep-sea fisheries should prevent or eliminate overfishing and ensure that levels of fishing effort do not exceed those commensurate with the long-term sustainable use of fishery resources (UNFSA article 5(a) and (h); CCRF article 6.3). Deep-sea fisheries should be assessed for their impacts on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks (UNFSA article 5(d)). They should also be managed to minimize the catch of non-target species and impacts on associated or dependent species such as coldwater corals and other vulnerable habitat forming species associated with seamounts, continental slope areas and hydrothermal vents (UNFSA article 5(f); CCRF article 6.6) and to protect biodiversity in the marine environment (UNFSA article 5(g)).

62. The Expert Consultation *noted* that, under the UNFSA, States should "develop data collection and research programmes to assess the impact of fishing on non-target and associated or dependent species and their environment, and adopt plans which are necessary to ensure the conservation of such species and to protect habitats of special concern" (UNFSA article 6.3(d)). States should "collect and share, in a timely manner, complete and accurate data concerning fishing activities" (UNFSA article 5 (j)) including deep-sea fishing activities on the high seas.

63. The precautionary approach should be applied to protect living marine resources and preserve the marine environment (UNFSA article 6.1; CCRF article 6.5) including from the adverse impacts of deep-sea fishing. States have the general obligation to protect and preserve the marine environment (UNCLOS article 192).

64. Flag States whose vessels engage in deep-sea fishing should ensure that the activities of vessels within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction (CBD articles 3, 4(b) and 5). States and RFMOs should, in accordance with international law, implement and enforce conservation and management measures in high-seas deep-sea fisheries through effective monitoring, control and surveillance (UNFSA 5(l) and 18-22; CCRF 6.10 and 6.11). All States, in cooperation with relevant RFMOs, should take sufficient measures for their respective nationals as may be necessary for the conservation of living resources of the high seas (UNCLOS article 117), cooperate with each other in the

[3] With respect to the UNFSA, the Expert Consultation noted that UNFSA applies to highly migratory fish stocks and straddling stocks but that its principles are relevant to management of high-seas deep-sea fisheries.

conservation and management of these resources in the areas of the high seas (UNCLOS article 118) and cooperate to protect and preserve the marine environment (UNCLOS article 197).

65. In developing and implementing conservation and management measures for deep-sea fisheries, States and RFMOs should take into account, *inter alia*, uncertainties relating to the size and productivity of the stocks, biological reference points, stock condition in relation to such reference points, levels and geographic distribution of fishing mortality and the impact of fishing activities on non-target and associated or dependent species, as well as existing and predicted oceanic, environmental and socio-economic conditions (UNFSA article 6.3(c); CCRF article 7.5.2)[4]. At the same time, the absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures to conserve target species and non-target, associated or dependent species, deep-sea habitats and the environment (UNFSA article 6.2; CCRF article 6.5).

Additional conservation challenges

66. The Expert Consultation *recognized* that the conservation objectives for deepwater populations, habitats, and communities are similar to those for shelf species and ecosystems. However, efforts to achieve those objectives face additional challenges in deepwater ecosystems. The additional challenges arise from several sources which are elaborated below.

67. One set of special challenges arises from the frequent lack of information needed to apply many of the usual tools for assessment of stocks and management of fisheries when working on deepwater ecosystems. Many standard assessment methods for estimating status and trends require time series of catch histories and/or survey estimates before they produce reliable estimates with moderate uncertainty. Neither of these are usually available for deep-sea fisheries until they have been operating for several years or more.

68. Many standard conservation reference points require estimates of population parameters derived from stock assessments. However, many of the preferred and more robust methods for making conservation objectives operational with quantitative reference points and measuring status against them are not available until the fisheries have been operating for some time.

69. Another set of challenges to achieving the four categories of conservation objectives, mentioned in paragraph 59 (a-d), arise from the lesser knowledge of the structure and function of deepwater ecosystems. Compared to many shelf ecosystems, for most deepwater ecosystems fewer of the individual components and relationships among them are known, and less is known about the natural patterns of variation and the nature and magnitude of forcing factors on the system dynamics. Thus, it is harder to identify the most sensitive and vulnerable parts of the deepwater ecosystems, and there is less certainty of the consequences of perturbing various parts of those systems. Hence there will be greater uncertainty in most steps of the assessment and management process, presenting challenges to science advisors, managers, policy-makers, and resource users in undertaking fisheries management.

70. The third set of challenges to achieving the four categories of conservation objectives arise from our general knowledge of, and experience with, deepwater ecosystems. These systems are often of lower productivity compared to shelf systems, and have a high proportion of species with life histories capable of sustaining only low exploitation rates (i.e. they are long-lived, have late ages of maturation, and have low rates of annual recruitment). Thus, the consequences of perturbations of deepwater ecosystem components pose a higher risk of serious or irreversible harm than would perturbations of similar absolute size in shelf or coastal systems. This has two implications. First, management should allow less disturbance of these systems to maintain desired levels of risk aversion in management. Second in the face of the greater uncertainties about both the ecosystems and the

[4] Particularly in the context of applying the precautionary approach.

stocks being exploited, and thus greater risk of serious or irreversible harm, management should be more precautionary and risk averse.

71. Overall, although the conservation objectives for deep-sea fisheries are similar to conservation objectives for shelf fisheries the circumstances under which they are achieved differ in several ways. These differences make their achievement more difficult for all parties involved in management. This has implications for what is needed in management strategies and tools for deep-sea fisheries, for data and research, and for governance and institutions.

72. The Expert Consultation *recommended* that the important messages implicit in these considerations are that management actions should be more precautionary than those implemented for shelf fisheries, and that the risks associated with perturbations of deepwater systems may be greater than the risks associated with similar perturbations of other types of marine ecosystems.

MANAGEMENT FRAMEWORKS AND TOOLS

73. Management tools and frameworks for deep-sea fisheries must consider the susceptibility of deep-sea species to rapid depletion. Deep-sea ecosystems are particularly vulnerable to damage for several reasons, including the following: they often have a long recovery period; data and understanding of deep-sea species and ecosystems are poor; research and stock assessment is difficult; and it is difficult to enforce, monitor and evaluate the success or failure of management measures.

74. The Expert Consultation *recognized* that many of the issues associated with the effective management of deep-sea fisheries differ in degree rather than substance from those associated with management of other fisheries. Therefore, recommendations for management that have been applied to fisheries generally are also applicable to deep-sea fisheries, but need to be applied even more stringently.

75. A range of tools and options are available, but management must be approached on a case-by-case basis. The tools and options for management presented in this section are not intended to be prescriptive or exhaustive. Rather, for each specific fishery managers need to decide on the appropriate approach and select management measures from the full suite of tools available. Decisions on these individual tools should support and be consistent with a strict application of the precautionary approach and an ecosystem approach to fisheries, because of the characteristics of deep-sea fisheries.

The precautionary approach

76. In defining and implementing the precautionary approach for high-seas deep-sea fisheries, it is possible to take advantage of the experience accumulated by RFMOs, such as CCAMLR, which has devoted significant effort to developing precautionary and ecosystem management approaches to fisheries management.[5]

77. Application of the precautionary approach needs to account for the special biological and ecosystem considerations in paragraph (73), as well as the logistical limitations of implementation and evaluation.

78. Following the example of CCAMLR's application of the precautionary approach the Expert Consultation *recommended* that no high-seas deep-sea fishery should be allowed to commence or expand in the absence of information necessary to ensure that the fishery can be developed and conducted in a sustainable way.

[5] CCAMLR's ecosystem approach distinguishes CCAMLR from many other international fisheries organizations as it addresses both direct and indirect effects of harvesting on ecological linkages between species as set in Article II of its convention. This approach requires exercising a level of precaution in developing management measures. It strives to minimize risks associated with unsustainable practices in the face of uncertainty arising from incomplete knowledge of either the fishery, or species, concerned.

79. In particular, the Expert Consultation *concluded* that adherence to the precautionary approach is required as a precondition for sustainable management of deep-sea fisheries and for deep-sea ecosystems and biodiversity to be conserved and protected. Tactics that have been applied to manage deep-sea fisheries need to be evaluated in light of their poor performance to date, particularly for low-productivity species. Regarding Annex II of the UNFSA, which specifies that the "fishing mortality rate which generates maximum sustainable yield should be regarded as a minimum standard for limit reference points" (Annex II, article 7), target reference points for the management of deep-sea species need to be set conservatively and well below maximum sustainable yield (MSY)-based reference points. In general, targets should be no greater than the estimated or inferred natural mortality rate, and preferably they should be less.

80. Decisions on Total Allowable Catch (TAC) and other conservation measures need to account for uncertainty and err in favour of conservation and sustainability. The Expert Consultation *recommended* that strategies that explicitly incorporate a "fishing down phase" for new fisheries of species known or inferred to have low productivity should be reconsidered, due to the almost universal tendency to substantially overestimate initial biomass and/or productivity.

81. Given the preceding considerations, provisions are needed to define the following main stages of a fishery's development: (i) new, (ii) exploratory, and (iii) assessed fishery in light of the species' vulnerability, to ensure that while knowledge is low, harvest rates and risk are kept low and harvests only increase as knowledge, management, capacity, and effective enforcement grow, as described in Appendix I. Additional provisions should be developed for pre-existing, lapsed and closed fisheries.

The ecosystem approach to fisheries (EAF)[6]

82. It is anticipated that the future management of living marine resources will be guided by an Ecosystem Approach to Fisheries (EAF) and that available guidelines (e.g. FAO Guidelines for EAF (2003); CBD guidelines (COP 5/Decision V/6, 2000)), as well as the relevant provisions of articles 5 and 6 of the UNFSA and articles 6 and 7 of the CCRF should be followed as closely as possible with respect to deep-sea fisheries. Management should include a detailed ecological risk assessment process that examines the risk of each type of fisheries and their associated gear and fishing seasons in relation to target species, bycatch, habitats, and ecosystem processes, structures and functions.

83. As the costs of research and management may be particularly high in deep-sea fisheries, a benefit/cost assessment of any potential deep-sea fishery should weigh the potential economic benefits against the cumulative costs of research, management and enforcement (FAO, 2003).

84. A process for EAF should include, as far as possible, all stakeholders. Potential outcomes resulting from the adoption of EAF include:

a) improved communication between stakeholders, policy makers and management;
b) identification of legitimate stakeholders;
c) available scientific information as a basis for negotiation with stakeholders;
d) co-management and joint decision-making;
e) ecolabelling and "chain of custody" labelling;
f) catch related measures aimed at motivating the industry to accept the EAF approach; and
g) education and awareness raising of the importance of sustainable use of marine ecosystems, which is the primary goal of EAF.

[6] The definition of EAF according to the FAO Technical Guidelines on 'The Ecosystem Approach to Fisheries' is as follows: "An ecosystem approach to fisheries strives to balance diverse societal objectives, by taking into account the knowledge and uncertainty about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries." (FAO, 2003)

Management strategy evaluation (MSE)

85. Management strategy evaluations using sophisticated computer models are now used in many parts of the world as a tool to evaluate the robustness of alternative management strategies to uncertainties in data and information. For many deep-sea species, the biological uncertainties that need to be taken into account include poor estimates of population biomass and life history parameters related to productivity, unknown or uncertain stock structure and stock dynamics, unknown stock-recruitment relationships and, in some cases, unknown but potentially substantial impacts of fishing on bycatch species, habitat and trophodynamics. Due to the lack of biological data and the high costs of collecting appropriate data, assessment models are likely to be simple, but due to the large number of sources of uncertainty, a large array of operational models may be required to cover the full range of plausible hypotheses about stock size, stock structure and population dynamics.

86. Management strategies that are robust to the full range of uncertainties are likely to result in low optimal exploitation rates, particularly for species with low productivity. It is theoretically possible to evaluate the potential effectiveness of alternative management strategies to achieve all four types of objectives presented in paragraph 59 (a-d). However, it will be much more difficult to model the uncertainties associated with dynamics of and fishery impacts on non-target species and biodiversity than it will be for target species of the fisheries. This makes it even more likely that the MSE approach will indicate that only low exploitation rates may be sustainable. Spatial habitat features and objectives can be included in MSE approaches, but usually require spatially structured operating models, which are demanding to construct.

Output controls

87. Description: Output controls define and regulate the amount of fish harvested by a fishery. They are commonly referred to as quotas or total allowable catches, and come in many variants, depending on how access rights are allocated within the fishery. Quota management is widespread in national and international jurisdictions, with both successes and failures to achieve the objectives of the management plans. In general, successful quota management requires both:

a) reliable assessments as a basis for setting the quota, which in turn requires knowledge of the productivity of the species being harvested, reliable catch data and, ideally, fishery-independent indicators of stock status, and;
b) high compliance with the management plan by the industry, which in turn requires either strong MCS programmes, including independent on-board observers, or a strong ethic of co-management and stewardship.

88. Where successful in restricting harvests to sustainable levels, the benefits of output controls are enhanced if combined with catch documentation schemes, which ensure markets can discriminate against fish harvested outside the quota management system.

89. Potential contribution to sustainability of deep-sea fisheries and conservation of ecosystems: With regard to the four types of objectives in paragraph 59 (a-d), output controls may have the following potential contributions:

a) **Target Species**: Output controls can promote sustainable use and protect target species if there is sufficient information to estimate stock status and productivity, quotas account for uncertainties, and there is effective compliance.
b) **Non-target species taken by the fishery**: There are cases where "bycatch quotas" have been used to restrict fisheries, with closures implemented when the bycatch allocation was fully taken, even if quotas of the target species are left unharvested. Fisheries, such as Pacific Halibut and Sablefish in the Canadian and Alaska groundfish trawl fisheries, and protected species of seabirds and marine mammals in a number of fisheries, are cases

where there was significant biological information about the bycatch species, such that bycatch quotes (or "caps") could be set, and there was a high level of independent observer coverage in the fisheries. Aside from such special cases, output controls are expected to provide little protection to non-target species taken in fisheries.

c) **Habitats**: Output controls provide no direct protection to habitat features, beyond restricting the total amount of fishing that will occur in an area.

d) **Biodiversity:** Except for special cases such as those described above in the non-target species paragraph, output controls provide no direct protection to general biodiversity, beyond restricting the total amount of fishing that will occur in an area.

90. Special considerations when applying output controls to deep-sea fisheries: The preconditions for output controls to provide for the sustainability of fisheries as well as the conservation of target species will rarely be met for deep-sea fisheries, particularly during the early years in which they are being prosecuted in a new area, or when flag State or RFMO control of the fisheries is inadequate. Even when the preconditions are met, output controls are not considered to be a particularly effective tool for protecting non-target populations, species, communities or habitats.

91. The Expert Consultation *recommended* that output controls only be considered as a potentially effective management tool for deep-sea fisheries when a functional, effective MCS regime is in place and when there is a robust and reliable assessment, or when TACs are set conservatively. Even in those circumstances, catch controls should be combined with catch documentation schemes for target species, and other measures for the protection of non-target species, communities, and habitats.

Input controls

92. Description: Input controls are intended to regulate the amount of fishing effort. There are many variants from programmes that limit entry of vessels into a fishery to complex programmes that allocate hours or days of fishing to individual vessels. The form of input controls that can be applied is strongly affected by the nature of allocation rights within a fishery. Effort management has been effective in contributing to the objectives of the fisheries management plan when the operations of the fishery were consistent across a fleet and over time, and there was some form of effective MCS, which could be on-board or remote monitoring (for example vessel monitoring systems [VMS]) of fishing activity.

93. Effort management is less effective when the fleet can modify fishing operations to increase efficiency of effort, or when there are opportunities to fish without the effort being counted in the management system. Effort management also requires a biological basis for determining the amount of effort to be allowed, either through a precautionary and restrictive approach to prevent rapid expansion of new fisheries, or through a reliable history of effort, catches and stock status for mature fisheries, so that a sustainable level of effort can be determined (see Appendix I). Input management schemes have been criticized for prompting sub-optimal economic investment strategies in fisheries, but some studies indicate that these inefficiencies can be identified and avoided with good planning.

94. Potential contribution to sustainability of deep-sea fisheries and conservation of ecosystems: With regard to the four types of objectives in paragraph 59 (a-d), input or effort controls may have the following potential contributions:

a) **Target species**: Effort management may make a valuable contribution to achieving sustainable use and protection of target species whenever the preconditions in paragraph 92 are met. Some form of effective and restrictive effort control is almost essential, particularly for new, exploratory and expanding fisheries (see Annex I), to ensure that the fishery does not expand so rapidly that sustainable exploitation rates are exceeded, and the stock of the target species depleted.

b) **Non-target species taken by the fishery**: On average, effort management can be expected to contribute to protection of non-target species of the fishery whenever the biological productivity of the non-target species is similar to or higher than the target species in the fishery, but not be sufficient to protect non-target species of lower productivity than the target species. Both generalizations depend on the relative catchability of the target and non-target species, including the spatial overlap of their distributions and their relative degrees of aggregation.

c) **Habitats**: Input controls provide no direct protection to habitat features, beyond restricting the total amount of fishing effort that can be applied in an area.

d) **Biodiversity**: As explained for non-target species, input controls can provide some protection to those biodiversity components that are as productive or more productive than the target species, but by themselves do not ensure that structural and functional properties of ecosystems are protected, particularly when key trophic roles such as dominant predators are filled by species of low productivity and high catchability.

95. Special considerations when applying input controls to deep-sea fisheries: Input controls can play a key role in managing new, exploratory and expanding fisheries in deepwater areas, when there is insufficient knowledge to estimate sustainable harvest rates and manage with output controls. However, the management of effort has to be effective, such that effort should be kept low until sufficient information has been collected on the productivity of the target and bycatch species, as well as the spatial distribution of vulnerable habitat and biodiversity features. During this period input controls should be combined with measures to manage the spatial distribution of effort to maximize the information gained from the fishery while keeping the total area affected by the new and expanding fishery relatively low. Once a deep-sea fishery has moved beyond the exploratory phase, input controls will usually continue to be a major component of management, combined with other measures to manage the impact of the fishery on low productivity species and vulnerable habitat features. The impact of different gear types and the way in which the gear is deployed in deep-sea fishing operations must also be considered in applying input controls.

96. Regulation of effort should be exerted by the flag States - individually and in cooperation with RFMOs where they exist. Consequently flag States, in cooperation with RFMOs, need to have effective programmes for managing the places and times where their flagged vessels operate, and exercise precaution in allowing their flagged vessels to move into new areas. The scale of the management programmes should be commensurate with the distribution of the target and non-target species and their habitats.

97. The Expert Consultation *recommended* that highly restrictive input controls are essential during the exploratory phases of deep-sea fisheries (see for example, the CCAMLR framework for exploratory fisheries), and should be a major component of management of “mature” deep-sea fisheries. However, they are not sufficient to ensure conservation of all important ecosystem components and habitat, not even the target species, without being accompanied by additional measures to manage the impact of the fishery on low productivity species and sensitive habitat features. It is essential for flag States to exercise full control over the operation of their vessels in deepwater areas, and exercise precaution in allowing their vessels to expand operations into new areas or for new target species.

Spatial and temporal management

98. Description: Spatial and temporal measures can be used to regulate fish harvesting in time and space to achieve a variety of objectives. Many governments and RFMOs have adopted measures such as seasonal and year-round closures to some or all fishing gears as components of ecosystem and precautionary approaches to protect, maintain or restore fish populations, non-target species, habitat structure, biodiversity and trophic integrity. These measures are most effective when:

e) a wider ecosystem-based management framework exists that includes comprehensive zoning so that, for example, excessive effort/capacity is not shifted to other areas;

f) compliance and effective enforcement measures are in place; and,

g) spatial data and/or models of target and bycatch species, and their associated habitats, are available.

99. In the absence of adequate baseline data, spatial controls on the expansion of existing, and initiation of new and exploratory fisheries, should be instituted as a precautionary measure, while sufficient information is obtained on species, habitats and ecological functions, to identify areas appropriate for fishing and those in need of protection.

100. Enforcement of spatial and temporal controls may be less costly and more effective than other management measures and recent advances in the use of VMS by RFMOs have demonstrated their utility in monitoring the activities of fishing vessels.

101. Potential contribution to sustainability of deep-sea fisheries and conservation of ecosystems: With regard to the four types of objectives in paragraph 59 (a-d), spatial and temporal management measures may have the following potential contributions:

a) **Target species:** Spatial and temporal measures are especially effective in protecting fish populations of low mobility, aggregations of fish at spawning times, feeding or nursery grounds and potentially enhancing the recovery of fish stocks.

b) **Bycatch species:** Such closures also protect bycatch species and can provide further protection when bycatch species are more vulnerable to overexploitation than the target species or are poorly studied.

c) **Habitats**: Spatial management tools can protect habitats by excluding fishing in areas they affect including important and vulnerable features of benthic habitats.

d) **Biodiversity:** Spatial management tools can protect components of ecosystems: areas that are closed to fishing will gain from protection of species abundance and richness, population structure, and genetic and habitat diversity. Given the paucity of species-specific information for most deep-seas fishery habitats, spatial and temporal management measures will contribute to protecting all biodiversity in a region.

Other benefits include**:**

*Resilience***:** Sustained fishing pressure can affect the population structure and genetic diversity of fish populations, even if the biomass of the target species is maintained. Both population structure and genetic diversity may be difficult to protect using non-spatial management means, and could represent a major benefit of closed areas.

*Scientific reference***:** Long-term protected areas may also serve as scientific reference sites to assist in distinguishing between the effects of harvesting and ecosystem changes, and provide opportunities for understanding marine ecosystems not directly subject to human interference.

102. Special considerations when applying spatial and temporal controls to deep-sea fisheries: The lack of knowledge about many deep-sea species or their ecological role can make their management difficult compared to situations where there is more information and thus less uncertainty. Mechanisms to accommodate the uncertainty relating to deep-sea species and their ecosystems are required. Properly designed and implemented, spatial management measures provide one way to accommodate uncertainty about many poorly known ecosystem components and processes.

103. As a preliminary measure, the spatial scale of management and reporting of deep-sea bottom fisheries may need to reflect the scale of deep-sea stocks and the frequent association of fishing activities with vulnerable marine ecosystems (twenty-sixth session of COFI, par. 88).

104. In data-poor areas, a representative approach to spatial protection may protect ecosystem components covering a range of species and habitat types within and across each bioregion. This approach has already been adopted in many shallow waters and is being developed on a wider scale.

105. Modelling can aid in identifying the potential distribution of species such as stony corals. Data already available for some deep-seas areas that can be used in such modelling or bioregionalization efforts include bycatch data, bathymetry data from bottom swath-mapping and oceanographic data.

106. Protection of unfished areas of deep-sea habitat and in areas where fisheries have lapsed, will protect intact habitats and allow damaged features to recover.

107. The Expert Consultation *emphasized* that as a part of EAF, spatial and temporal management tools, including marine protected areas, are particularly useful in data-poor situations such as those encountered in the deep seas. These tools could contribute to precautionary management and, if appropriately implemented, provide protection of biodiversity, habitats and fish stocks.

Harvesting entitlements

108. There are undesirable consequences from open-access or competitive fisheries. Under such management regimes, competitive pressures will deter operators from providing the information that is needed for optimal management of the resources. Indeed, providing fishing data will likely penalise the company that is the source of the information. The benefits that can arise from secure, exclusive and transferable fishing entitlements are well documented and reported (Shotton, 2000a,b).

109. Potential contribution to sustainability of deep-sea fisheries and conservation of ecosystems: With regard to the four types of objectives in paragraph 59 (a-d), harvesting entitlements have the following potential attributes:

a) **Target Species:** Fishing operators are assigned a specific entitlement to catch a particular species, and effective entitlements may contribute substantially to the sustainable use of target species.

b) **Non-target species taken by the fishery:** Harvesting entitlements may not provide sufficient protection to non-target species taken in fisheries. Thus, it may be useful to assign harvesting entitlements for bycatch species in addition to those granted for target species. In this case, fishing must stop once an individual operator reaches his entitlement limit or the operator must obtain additional bycatch entitlements from another operator. Fishing must also stop once the TAC for bycatch is filled. Entitlement systems can be expected to be as effective in ensuring sustainable use of non-target species as of target species, although it is likely that less information would be available for estimating the quotas for bycatch species, requiring more precaution and more restrictive bycatch TACs.

c) **Biodiversity and habitats**: Harvesting entitlements, alone, may not ensure adequate biodiversity and habitat protection unless complimentary measures are adopted as part of the negotiation process associated with entitlements.

110. Adopting such essential management approaches in a high seas context requires recognition of the cost to effective management of an unconstrained right to fish, and the mutual exclusivity of the "right to fish" with the expectation that there will be full and effective cooperation and sharing of information. Implementation of means provide secure, exclusive and transferable fishing entitlements may be a method of achieving effective management of high-seas fisheries. However, the potential utility and practicality of catch entitlements on the high seas remains to be determined.

111. The Expert Consultation *considered* that the utility and feasibility of providing transferable fishing entitlements for high-seas fisheries, as well as the processes and means for doing so, should be determined and evaluated by an appropriate international consultation.

DATA AND RESEARCH

Fisheries inventory

112. The Expert Consultation *supported* the development of regional inventories of fisheries (see additional FAO documentation distributed, Appendix 2.A of the Report). There are several issues that need to be considered for each fishery for a scientific assessment of the status of fish stocks and the impacts of the fishery.

Fishery reporting requirements

113. Historical fishing data: Many regions of the world's oceans and areas beyond national jurisdiction were explored, fished, and researched during the 1960s-1980s by distant water fishing nations (e.g. former USSR, Spain, Japan, Republic of Korea), and from the 1980s-1990s by other nations. Much of this historical data are not reported in FAO catch statistics. The Expert Consultation *noted* that such information would be an important contribution to knowledge of past high-seas fishing. Further, knowledge of the total historical catches is critical to reliable assessments of the current status of deepwater stocks. The Expert Consultation *noted* that lack of data on total mortality (actual catches) of exploited stocks typically led to inadequate assessments. A coordinated and cooperative effort is needed involving all present and past deepwater fishing countries to document historical deep-sea fishing activities. Data are required on fishing locations (as detailed as possible), fishing effort (number and duration of tows), gear type, and catches (of individual species). Oceanographic (biological, physical, chemical, geological and environmental) data would be useful but are secondary to the immediate need for fishery information.

114. The Expert Consultation *recommended* that FAO urgently develop a programme to coordinate the retrieval, collation and storage of all historical high-seas catch and effort information. The Expert Consultation *recognized* that delays in setting up such a programme will make it more difficult to recover historical data, and records will be incomplete.

115. Current and future fishery data reporting systems: While many countries require their vessels to provide full recorded information on their high-seas fishing activities, this is not the case for all. The amount of information on fishing activities also varies between countries, from basic daily position and catch to full individual fishing operation details (i.e. tow-by-tow data). Missing and incomplete data on deep-sea fisheries prevent effective analysis and interpretation of the nature and extent of fishing operations, and the effects of the fisheries on fish stocks and habitat. Immediate efforts are required to ensure that information on current high-seas deep-sea fisheries are recorded in appropriate formats and in sufficient detail.

116. Because deepwater stocks may have localized distributions (in some cases, on a single seamount or ridge feature) the spatial precision of reporting is important. The Expert Consultation *recognized* that data at the level of individual trawls or sets is the ideal objective.

117. The Expert Consultation *recommended* that standardised logbook formats (separate fishery catch-effort and biological forms) should be produced and adopted across all deep-sea fisheries on the high seas. This would require cooperation and coordination between RFMOs/As and national agencies to standardize forms where appropriate. Electronic data collection and reporting systems such as electronic logbooks should be investigated.

118. In addition to recording the catch of target and bycatch commercial species, information on the catch of discarded species and benthic invertebrates (e.g. coral, sponges, seastars, crabs) is required. The Expert Consultation *recommended* that more detailed training programmes for fishers and scientific observers are desired to improve catch identification and biological data collection in offshore areas where different species to those in national waters may be encountered. Such programmes may need to be implemented and coordinated by FAO in some regions, especially where

capacity building in developing countries is needed. Manuals or identification sheets to aid training may need to be prepared or adapted from national documents.

119. Research and data collection plans should be prepared, where appropriate, to guide scientific observers and vessel crew to deliver the required level of information for resource assessment.

120. Observer programmes have been limited, and the presence of trained observers on vessels would benefit all aspects of deep-sea fisheries management, especially the new and exploratory stages of a fishery's development (see Appendix I). For the latter, special consideration should be given to the extent of observer coverage.

121. Vessel registry data are required to identify changes in the fishery composition, fishing power, and gear types to help interpret changes in fishery performance. The vessel registry information required is of the type described under Article VI of the Compliance Agreement. Flag States are required to maintain a record of fishing vessels under Article IV of the Compliance Agreement and to make available to FAO the information maintained in such records pursuant to Article VI.

122. Because fish availability/abundance may vary with changing environmental conditions, recording such variables as bottom temperature is important for interpreting changes in catch rates and fishery performance.

123. The Expert Consultation *noted* that the timely provision of such data to the appropriate national body, RFMO/As, and FAO is important to ensure regular analysis and monitoring of fisheries is based on up-to-date information. The frequency of this will depend upon the duration of high-seas fishing trips, which can be variable, but often last several months.

Maintenance of data

124. To enable appropriate descriptive analyses of fisheries, as well as more detailed scientific assessment, data should be centralized in a single database on a regional basis. This facilitates monitoring adequacy of data and ease of analysis.

125. The Expert Consultation *recognized* that flag States should accept responsibility for providing accurate data.

126. Access to data, data sharing, and confidentiality of data are issues to be resolved by the regional bodies, arrangements, and national authorities. For RFMOs, one option would be to adopt the CCAMLR model whereby a central database is maintained, but individual flag States may only access other countries' data with their permission.

Resource assessment data requirements

127. The Expert Consultation *did not consider* scientific stock assessments in detail, as the structure of scientific research programmes will depend upon the nature and conditions of each region, ecosystem, and stock being fished. However, a number of important elements that need to be considered for such assessments were identified and are elaborated below in paragraphs 128-133.

128. Stock structure identification for which a range of information may be needed (e.g. fishery location, distribution of spawning sites, biological characteristics, genetic composition, etc.).

129. Biomass estimation is difficult for many, if not most, deepwater species. In many cases standard fishery methods such as trawl surveys, catch-per-unit-effort analyses, or acoustics surveys have not proven successful in providing robust assessments, even in national fisheries where major research programmes have been undertaken. Given the limited resources likely to be available in offshore fisheries on the high seas, and the urgent need in new fisheries for immediate management,

fishery dependent techniques (e.g. catch per unit of effort), and/or techniques able to be applied on commercial vessels (e.g. acoustic surveys) may need to be implemented. However, the application of such methods has been contentious in some countries. New and innovative methods may need to be developed.

130. Biological information is required for stock structure identification (e.g. length frequency, reproductive stages) and spatial scale definition, and age/growth determination is necessary for productivity estimation. Observer systems may be needed to ensure collection of adequate data. When new fisheries are developed, or new areas explored, biological parameter values from the species in other regions may be used. For most deepwater species, approximate values of biological parameters are available from national research programmes.

131. Habitat information: Bycatch data should be recorded routinely. If fishing vessels have used satellite altimetry or swath-mapping data to identify fishing grounds, these data should be provided to management agencies to aid assessing likely impacts of fishing on the ecosystem.

132. Catch information: An accurate catch history of all key species caught in the fishery is needed to evaluate changes in stock characteristics and community structure. Information on the characteristics of the fishing operation will inform scientists and managers of changes in fishing practices that affect data interpretation.

133. At this stage, the Expert Consultation *believed that* it is most important to ensure that the necessary data are collected. Arrangements for more detailed stock assessment should be the responsibility of the individual RFMO/regional bodies.

Resource assessment process

134. Stock assessment models that are applicable to deepwater species are generally the same as those applied to shelf species. However, for many deepwater stocks it is difficult to provide robust stock assessments due primarily to data limitations. For example, age-structured models are not very useful when the ages of (long-lived) species cannot be estimated either accurately or precisely. The resources available for monitoring and assessment of high-seas fisheries may also be a constraint, and dictate that lower cost or innovative methods based on simpler forms of monitoring and assessment may need to be developed.

135. Collection and use of non-fishery data may be needed in such data-limited situations. The Expert Consultation *supported* the promotion of research on cost-effective ways for the routine collection of deepwater sea floor and benthic habitat information in the course of normal fishing operations. Examples are remote sensing data (e.g. satellite data, bathymetric data collection, swath mapping, development of deep gear-mounted camera systems) that can help determine the extent of habitat types, or new predictive modelling methods that can estimate the possible distribution of faunal groups or vulnerable habitat.

GOVERNANCE FRAMEWORK AND IMPLEMENTATION

136. The current legal and institutional framework relating to the conservation and management of deep-sea fisheries contains gaps and shortcomings at the global, regional and national level.

137. At the regional level, there is a need to establish new RFMOs/As with the competence to manage deep-sea fisheries. While negotiations to establish these in the Southern Pacific and the North-west Pacific are already underway, there are currently no RFMOs/As in the Central Atlantic, the South-west Atlantic, the Central Pacific, the North-east Pacific and areas of the Arctic. In some of these regions, establishing RFMOs/As cannot be achieved unless developing coastal States are provided with substantial assistance. Such assistance should not only be provided for the establishment phase, but also to ensure the adequate performance of the RFMOs/As once formed.

138. The constitutive instruments of these RFMOs/As should relate to straddling fish stocks as well as to discrete high-seas fish stocks and should be consistent with UNFSA and other international laws, in particular the precautionary approach to fisheries and the ecosystem approach to fisheries. Where appropriate and necessary, RFMOs/As should establish bodies dedicated to dealing with deep-sea fisheries. Moreover, they should cooperate and coordinate with other relevant regional institutions, such as United Nations Environment Programme (UNEP) regional seas programmes, other regional marine environmental protection organizations (e.g. the OSPAR Commission) and regional scientific advisory bodies (e.g. International Council for the Exploration of the Sea [ICES] and North Pacific Marine Science Organization [PICES]). RFMOs/As are also encouraged to cooperate with industry and environmental non-governmental organizations (NGOs).

139. Existing RFMOs/As (e.g. the GFCM) should be reformed to achieve a similar result.

140. One of the most prominent legal gaps in the relevant legal and institutional framework at the global level is the non-applicability of the UNFSA to discrete high-seas fish stocks. The existence of this gap has been recognized, *inter alia*, by the UNGA in its 2005 'Sustainable Fisheries' Resolution (A/RES/60/31) and by the UNFSA Review Conference in May 2006. The global legal and institutional framework has many other shortcomings, for instance in the regime for sedentary species, both on the continental shelves of coastal States and on the sea bed beyond the limits of national jurisdiction (the Area), and the absence of a benchmark and rules on the allocation of fishing opportunities.

141. The Expert Consultation *noted* that States and RFMOs/As would benefit from the development of technical guidelines on the conservation and management of deep-sea fisheries, with particular emphasis on the broader ecosystem impacts of such fisheries and the identification of vulnerable marine ecosystems. In addition, States should consider the need for an international plan of action (IPOA), a model arrangement or a legally binding instrument (whether or not developed within FAO). The latter instrument could address the legal gaps mentioned above. In addition, it may create a mandate for a new or existing global body to perform certain tasks (e.g. providing scientific and technical expertise) related to deep-sea species and fisheries (whether or not in the absence of competent RFMOs/As). FAO may wish to convene additional consultations to examine the various options.

142. In their efforts to ensure the preservation of deep-sea biodiversity, States and RFMOs/As should draw on the scientific and technical expertise of existing expert bodies such as, *inter alia*, ICES and PICES, and strengthen their own scientific advisory bodies. States, RFMOs/As and FAO should cooperate with the regime established under the CBD in the preservation of deep-sea biodiversity.

143. The Expert Consultation *recognized* that there are areas beyond national jurisdiction where the conservation of deep-sea species and their ecosystems in which they occur would benefit from the establishment of MPAs or other spatial management tools. Support was also expressed for efforts, whether at the regional or the global level, to establish integrated and cross-sectoral (i.e. encompassing all human activities) MPAs in areas beyond national jurisdiction, while the complexities that would be associated with such an initiative were acknowledged.

144. While many RFMOs/As only have the power to establish MPAs for a single purpose - namely the sustainability of target resources - some RFMOs/As have the competence to establish MPAs for other purposes, for example for the conservation of non-target resources and habitats. The Expert Consultation *encouraged* RFMOs/As to broaden their competence to allow the establishment of MPAs for a variety of purposes in light of the ecosystem approach to fisheries.

National frameworks

145. States acting in their capacity as flag States, port States, market States and by exercising jurisdiction over their nationals, should contribute to the conservation and management of deep-sea fisheries, especially given the abovementioned gaps in the global and regional frameworks. The potential effectiveness of national frameworks stems from the fact that States possess jurisdiction and control over their vessels and other nationals participating in deep-sea fisheries within their own maritime zones and in areas beyond national jurisdiction, and have extensive jurisdiction over their ports and territory in respect of fish landings and entry of fish and fish products into their markets.

Flag States

146. It is of particular importance that flag States ensure that their fishing activities are conducted in a manner that is consistent with State responsibilities for the conservation of living marine resources under international law. The Expert Consultation *agreed* that flag States should therefore apply the UNFSA, the Compliance Agreement, the CCRF and the IPOA-IUU to deep-sea fishing activities by their vessels. Among other things, they should establish legal pre-requisites for entry into a deep-sea fishery or conditions applicable to participants in a deep-sea fishery after entry (e.g. through fishing authorizations or the granting of fishing rights), subject their vessels to monitoring, control and surveillance measures and provide FAO and/or relevant RFMOs/As (including preparatory bodies or negotiation processes) with information on their fishing activities.

Port States

147. Port States should act as a "responsible port State" and adopt and implement national legislation that will serve to combat illegal, unreported and unregulated (IUU) fishing for deep-sea species. In particular, port States and RFMOs/As should cooperate in efforts to address IUU fishing activities, for instance through catch documentation schemes or similar market-related measures and on actions against vessels on IUU vessel lists. Moreover, they should make the fullest possible use of their jurisdiction under international law and participate in initiatives to combat IUU fishing activities. Port States are also encouraged to implement the FAO Port State Model Scheme and to support initiatives to transform this scheme into a legally binding international instrument.

Market States

148. The Expert Consultation *recognized* that jurisdiction by States in their capacity as market States is currently underutilized and this capacity may facilitate the conservation and management of deep-sea fisheries, especially for species with high market values. Catch documentation schemes, similar market-related measures and denial of market access should be adopted and implemented, consistent with international trade law, to support multilaterally agreed conservation and management measures for deep-sea fisheries.

Monitoring, control and surveillance (MCS)

149. Well-developed and implemented national MCS frameworks are vital components for global, regional and national conservation and management regimes. Satellite-based VMS in combination with catch reporting are especially effective for deep-sea fisheries if integrated into the overall MCS framework and used in association with the establishment of temporal and spatial management measures, including MPAs. The Expert Consultation *recommended* that States should participate in the International Monitoring, Control and Surveillance Network for Fisheries Related Activities.

150. The Expert Consultation also *noted* that measures such as catch/quota documentation schemes can complement VMS and enhance the ability of port and market states to identify vessels and their catches in violation of compliance measures.

CONCLUDING REMARKS AND SUMMARY OF RECOMMENDATIONS

151. The Expert Consultation *recognized* that the issues associated with the effective management of deep-sea fisheries differ in degree rather than substance from those associated with management of other fisheries. Many deep-sea species centred below 200 m have similar life history characteristics to shallower-water species, and several deepwater species are highly productive and support large fisheries (e.g. blue whiting). Increasing numbers of species with life history characteristics associated with low productivity are encountered as depth increases. Below about 400-600 m, high-biomass, commercially-important species often have slow growth rates, high ages of maturity and maximum ages of the order of several decades to more than one hundred years. Even though the pre-fishery biomass of these species may be large, sustainable exploitation rates have been found to be extremely low. Benthic organisms such as coldwater corals that may be affected by bottom fishing throughout the 200+ m depth range also have extremely slow growth rates and recovery times that may be of the order of centuries.

152. The Expert Consultation *recommended* that when discussing deep-sea fisheries, it would be useful to distinguish highly productive shallower-water species from low-productivity deeper species (See indicative example of summary information on high-seas deep-sea species in Annex II and III). It would also be useful to be able to distinguish between catches within and outside EEZs. At present, FAO data do not provide sufficient detail to enable such characterization.

Data and research

153. The Expert Consultation *recommended* that:

154. FAO data should be compiled and provided at a much finer scale of spatial resolution that, at the least, is sufficient to enable separation of catches by depth and EEZ/high-seas locations.

155. In addition, FAO should coordinate a data documentation programme to secure, collect and store information on historical catch, effort, fishing locations and oceanographic data that exist but are known to be missing from existing databases.

156. Fishery-dependent data required for stock assessments and management should be collected and reported to the appropriate national body or RFMO/A. These data should include vessel and gear characteristics, location of fishing activity, and catch and effort data at the level of individual tows or set. Standardized logbook formats should be developed and adopted across all high-seas deep-sea fisheries.

Sustainability

157. The Expert Consultation *concluded* that, for deep-sea species whose depth range overlaps that of continental-shelf and (neritic) shallow water species and are highly productive, sustainable management of target species is an achievable objective, although effects of bottom gears on habitat may be an issue. For low-productivity deep-sea species, such as orange roughy and oreos, the track record so far is discouraging and their continued sustainability remains uncertain. There is widespread concern (but not necessarily empirical evidence) that fisheries on some species with exceptionally low productivity (e.g. deepwater sharks) may be unsustainable even at very low levels of fishing mortality.

158. Given that management issues for deep-sea fisheries differ in degree rather than substance, recommendations for management that have been applied to fisheries generally are also applicable to deep-sea fisheries, but need to be interpreted even more strictly. In other words, strict adherence to the precautionary approach is a minimum requirement for ensuring sustainability of deep-sea fisheries.

159. Therefore, the Expert Consultation *recommended* the strict adherence to the precautionary approach, along with application of an Ecosystem Approach to Fisheries to ensure that deep-sea fisheries are sustainable.

160. The Expert Consultation further *recommended* that:

161. There is a need to establish new RFMOs/As with the competence to manage deep-sea fisheries, where such competencies do not yet exist, and to strengthen and broaden the competence of existing RFMOs/As so that they can manage high-seas deep-sea fisheries sustainably and effectively.

162. All deep-sea fisheries should be managed subject to appropriate conservation measures: new fisheries should be prosecuted consistent with documented management plans to ensure that the information needed for their effective management is gathered. The CCAMLR approach provides a possible model. Formal ecological risk assessments should be conducted prior to the initiation (and/or continuation) of high-seas deep-seas fisheries.

163. Highly restrictive input controls (e.g. gear restrictions and controls on the number and size of fishing vessels and the number of days they are allowed to fish) should be put in place during the exploratory phases of deep-sea fisheries, and should be a major component of management of "mature" deep-sea fisheries.

164. Output controls (e.g. catch limits) may only be an effective tool for management of deep-sea fisheries when effective MCS is in place and there is a robust and reliable assessment or when TACs are set conservatively.

165. Spatial and temporal management tools such as MPAs, spawning closures and seasonal closures, are particularly useful in data-poor situations as occur in the deep seas. These tools could contribute to management using a precautionary approach and, if appropriately implemented, provide some level of protection for biodiversity and habitats and fish stocks.

166. RFMOs/As, and flag States for areas where no RFMO/A exists, should consider agreeing to "freeze the footprint" of current deep-sea fisheries until and unless adequate data can be collected to conduct stock assessments to inform management decisions and an agreed approach to exploratory fishing can be developed. "Freezing the footprint" means (a) no expansion of fishing into new areas, (b) no increase in catch over that of recent years and (c), no increase in effective fishing effort (e.g. number of vessels x gross registered tonnage (GRT) x days) over recent years.

167. Participating States should provide data on catch, effort and location of past high-seas deep-sea fisheries to the relevant RFMOs/As or flag States.

168. For existing high-seas deep-sea fisheries, RFMOs/As and flag States should develop appropriate measures that are more precautionary than those advocated for other fisheries. For example, target exploitation rates should not exceed the estimated natural mortality level of the target stock and ideally should be less than this level.

169. In accordance with current management practices of many States and RFMOs/As, vulnerable habitats and ecosystems within the area of existing fisheries should be identified. Such habitats could be protected through States agreeing on areas where deep-sea fisheries should be prohibited or alternatively, permitted.

170. States should establish requirements for vessels wishing to develop new areas for high-seas deep-sea fisheries, including reporting requirements, management measures and effort limitations, as well as requirements for scientific observers on vessels.

171. Strategies that have been applied to manage deep-seas fisheries need to be evaluated in light of the poor performance to date. Management reference points need to be set conservatively and well below MSY-based reference points. TAC decisions or decisions on other conservation measures need to account for uncertainty and err in favour of conservation and sustainability. Strategies that explicitly incorporate a "fishing down phase" for new fisheries should be abandoned, due to the almost universal tendency to substantially overestimate the initial biomass.

172. The effects of deep-sea fisheries on habitat and biodiversity must be evaluated and habitat mapping of possible fishing areas should be conducted. Area-based (e.g closed areas to protect vulnerable habitat) and other conservation tools should be applied to reduce bycatch and habitat impacts.

173. Research is needed to improve resource assessments, knowledge about the distribution of resources and fishing grounds, understanding of stock structure, and to determine the functional value and vulnerability of habitat and biodiversity. Research efforts of countries involved in deep-sea fisheries will benefit from more international coordination, cooperation and information sharing.

174. Multilateral arrangements are needed to manage high-seas deep-sea fisheries in some geographic areas, specifically those mentioned in paragraph 137. As in high-seas tuna fisheries, some high-seas deep-sea fleets operate globally. Hence, international organizations dealing with these fisheries would benefit from close coordination and communication, if not from formal linkages.

175. Where there are no multilateral arrangements to manage high-seas deep-sea fisheries individual flag States should prevent overfishing on the high seas by consistently applying the UNFSA, the Compliance Agreement, the CCRF and the IPOA–IUU to deep-sea fishing activities by their vessels.

176. In general, there is a need to improve compliance with fishery conservation measures, such as TACs and reporting of fishery dependent data from deep-sea fisheries.

177. States should implement appropriate actions to ensure compliance with conservation measures that encompass discrete high-seas and straddling stocks.

178. States should agree on appropriate port State measures and take note of current FAO initiatives on this topic.

179. The potential for catch documentation schemes to assist in management of deep-sea fisheries has been established and, where beneficial, this process should be extended to other species.

180. States should participate in the International MCS Network.

Future work to be overseen by FAO

181. The Expert Consultation *noted* that there is a need to develop technical guidelines – and eventually an IPOA, a model arrangement or a legally binding instrument (whether or not developed within FAO) – for high-seas deep-sea fisheries. The report of the meeting and the background papers provide a good starting point for developing such guidelines. FAO should oversee the development of the technical guidelines. The key audience should be RFMOs/As and States.

182. FAO should communicate with RFMOs and States in regard to the above process and ask for input on future direction. A Technical Consultation should be convened before finalizing guidelines.

183. Activities that will contribute to knowledge of deep-sea fisheries should be pursued. The Expert Consultation *recommended* that the FAO should consider, *inter alia*: conducting a global review of deep-sea fisheries; consultations regarding legal issues relating to the deep-sea regime;

further research on and collection of historical high-seas data; and support for and promotion of research on cost-effective ways to collect data on deep-sea stocks, as well as deep-sea sea floor and benthic habitats.

184. Cooperative efforts to conserve, protect and promote sustainable use of deep-sea fisheries should be initiated by FAO with consideration of and cooperation with relevant mechanisms such as those established by the CBD. In addition, collaborative research based on the issues raised at the Expert Consultation should be pursued by FAO.

185. The Expert Consultation *recommended* that the much discussed issue of destructive fishing in the deep seas be further investigated, specifically for deep-sea fishing on the high seas. Elaboration of the definition and further guidance on reduction of such practices would be beneficial and consistent with the recommendations of World Summit on Sustainable Development (WSSD 2002, para 32 [c]).

ADOPTION OF THE REPORT

186. The above conclusions and recommendations were adopted by the Expert Consultation on 23 February, 2007.

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ANNEX I: Illustrative regulatory framework for fisheries

i. **New fisheries:** fisheries should be managed from the time that they commence. Pre-notification of any new fishery to flag States and relevant RFMOs should be mandatory, particularly when fishing is targeting species, and/or a fishing ground, that has not previously been fished. Upon notification the regulatory body should be mandated to issue: (a) a standardized data collection plan, including international observers aboard, to collect information on target and bycatch species; (b) specify location of fishing; (c) a fishery operation plan, which should include precautionary measures to reduce impacts upon habitat and bycatch species and, eventually, global or spatial limitations on catch and/or effort.; and (d) a research plan aimed to collect additional information on a fishery-by-fishery basis. The data collection and research plans would be critical tools to successfully assess the fishery since governmental research programs are expected to be insufficient to support assessments outside national jurisdictions.

ii. **Pre-existing fisheries:** immediate action should be taken to incorporate existing fisheries into the regulatory framework for the high-seas deep-sea fisheries. This should include registering of areas, vessels and flag States involved and rapid implementation of data collection and fisheries operation plans. For the latter, three basic options are considered as interim measures for a fishery until it evolves to what could be considered a managed fishery on an assessed stock (or stock complex):

   a. freezing the current effort in terms of vessels and areas exploited at the finest possible level of resolution;
   b. reducing the current effort to the nominal levels needed to provide information for assessing the fishery and obtaining relevant habitat and ecosystem information; or
   c. closing the fishery if the risk of severe impact on unique habitat, ecosystem or species is assessed as extremely high given available information.

iii. **New and pre-existing deep-sea fisheries** should be classified as exploratory and remain classified as such until sufficient information is available to:

   - evaluate the distribution, abundance and demography of the target species, leading to an estimate of the species' (or stocks') potential yield;
   - review the fishery's potential impacts on dependent and related species; and
   - formulate and provide advice on appropriate harvest catch levels, as well as on effort levels and fishing gear, and spatial patterns of operation where appropriate and demonstrated capacity exists to ensure high compliance of the fishery with pertinent management plans, including IPOAs.

iv. **Assessed fishery:** defined as a fishery where sufficient knowledge allows the fishery to continue at a sustainable level and therefore not be subject to all of the regulations of an exploratory fishery. All assessed fisheries should be characterized by data collection, fisheries operation and research plans[7] updated yearly. Fisheries operation plans should comprehensively summarise information on each fishery, including a list of all regulatory requirements, including catch limits and, should they be used, input controls and controls on spatial operations of the fishery.

[7] Research plans can include monitoring the fishery operations, surveying with acoustic or fishing technologies, tagging programmes, habitat and oceanographic monitoring programmes.

ANNEX II: Summary information on selected high-seas deep-sea target fisheries and species [*note that relative productivity is a subjective ranking*]**. This information is intended to be indicative and an example for further work.**

Species		Main depth range (m)	Gear type	Region	Category	Relative productivity
Alfonsino	*Beryx splendens*	400–600	Bottom, and midwater trawl, some longline	North Atlantic, North Pacific, Indian Ocean, South Atlantic, South Pacific	Demersal/bentho-pelagic	M-H
Cardinalfish	*Epigonus* spp. (E.*telescopus, E. denticulatus, E. parini*)	500–800	Midwater trawl	South Pacific, Indian Ocean	Bentho-pelagic	M
Blue ling	*Molva dypterygia*	250–500	Bottom trawl	North Atlantic	Demersal	M
Black scabbardfish	*Aphanopus carbo*	600–800	Line, bottom, and midwater trawl	North Atlantic	Demersal/bentho-pelagic	M
Sablefish	*Anoplopoma fimbria*	200–800	(Bottom trawl), line	Northeast Pacific	Demersal-bentho-pelagic	L
Armourhead, boarfish	*Pseudopentaceros* spp.*(P. wheeleri, P. richardsoni)*	250–600	Bottom and midwater trawl	North Pacific, Indian Ocean	Bentho-pelagic	M
Orange roughy	*Hoplostethus atlanticus*	500–1 200	Bottom trawl	North Atlantic, South Atlantic, Indian Ocean, South Pacific Ocean	Demersal	L
Oreos	*Pseudocyttus maculatus, Allocyttus niger*	600–1 200	Bottom trawl	South Pacific, Indian Ocean, South Atlantic	Demersal	L
Redfish	*Sebastes* spp. *(S. marinus, S. mentella, S. fasciatus, S. proriger)*	400–800	Bottom and midwater trawl	North Atlantic, North Pacific	Demersal/bentho-pelagic	M-L
Roundnose grenadier	*Coryphaenoides rupestris*	800–1 000	Bottom, and midwater trawl	North Atlantic	Demersal/bentho-pelagic	M-L
Toothfish	*Dissostichus* spp. (*D. eleginoides, D. mawsoni*)	500–1 500	Bottom trawl, longline	South Atlantic, Indian Ocean, CCAMLR region	Demersal	M
Greenland halibut	*Reinhardtius hippoglossoides*	300–1 500	Bottom trawl, gill net, longline	Northwest Atlantic	Demersal	M
Mackerel species	*Scomber* spp., *Trachurus* spp.	200–600	Midwater trawl (bottom trawl)	North Atlantic, South Pacific	Pelagic/bentho-pelagic	H
Deepwater sharks	*Centroscymnus* spp. *Centrophorus* spp. (and others)	500–1 000	Bottom longline, Deepwater gill net, bottom trawl	North Atlantic, South Atlantic, Indian Ocean, South Pacific	Demersal	L
Shrimps	*Pandalus* spp.	200–500	Shrimp trawl	Northwest Atlantic	Demersal	H
Squid	*Illex* spp.	300–400	Bottom trawl, jig	South Atlantic (CCAMLR)	Demersal/bentho-pelagic	H

ANNEX III: Summary information on selected high-seas deep-sea minor, bycatch, lapsed or closed fisheries. [*note that relative productivity is a subjective ranking*]**. This information is intended to be indicative and an example for further work.**

Species		Main depth range (m)	Gear type	Region	Category	Relative productivity
Rubyfish	*Plagiogeneion rubiginosum*	250–450	Bottom, and midwater trawl	South Pacific, Indian Ocean	Bentho-pelagic	M
Pink maomao	*Caprodon* spp. (*longimanus*)	300–450	Bottom, and midwater trawl	South Pacific (lapsed)	Bentho-pelagic	H
Bluenose	*Hyperoglyphe* spp*. (H. Antarctica, H. perciformis*)	300–700	Bottom, and midwater trawl (line)	South Pacific, Indian Ocean, South Atlantic	Demersal/bentho-pelagic	M
Rough-headed grenadier	*Macrourus berglax*	800–1 000	Bottom, and midwater trawl	Northwest Atlantic	Demersal/bentho-pelagic	M
Notothenіid cods	*Notothenia* spp.	200–600	Bottom trawl, longline	CCAMLR (closed)	Demersal	M
Icefish	*Champsocephalus gunnari*	500–800	Bottom trawl	CCAMLR	Demersal	M
Wreckfish	*Polyprion* spp. (*P. americanus, P. oxyprion*)	200–800	Line (bottom trawl)		Demersal	M
Silver scabbardfish	*Lepidopus caudatus*	300–1 000	(Bottom) and midwater trawl		Demersal-bentho-pelagic	M-H
Skates, rays	*Raja* spp., *Bathyraja* spp.	500–1 500	Bottom trawl, Line (Antarctic)	South Atlantic, CCAMLR	Demersal	L
Rock lobster	*Jasus* spp.	<400	Pot/trap	South Atlantic, Indian Ocean	Demersal	L
Deepwater crab	*Lithodes* spp.,*Paralithodes* spp., *Chaceon* spp., *Chionoecetes* spp.	?500–1 000	Pot/trap	Northeast Pacific, South Atlantic	Demersal	L
Red shrimps	*Aristeus* spp., *Aristaeomorpha* spp.	600–1 000	Shrimp trawl	Western Mediterranean	Demersal	M-H
Precious coral	*Corallium* spp.	300–500	Tangle dredge	Global	Demersal (sedentary)	L

APPENDIX 1.A

Agenda

1. Opening of consultation

2. Selection of officers

3. Presentation: Management (Pamela Mace)

4. Presentation: Legal and institutional issues (Erik Molenaar)

5. Presentation: Issues relating high seas marine protected areas to the management of deep-sea fisheries and the conservation of related resources (Kristina Gjerde)

6. Additional presentations made available by participants

7. Presentation: Resources and fisheries (Dave Japp)

8. Group discussion of main topics
   a. Conservation objectives
   b. Management frameworks and tools
   c. Data and research
   d. Governance framework and implementation

9. Individual group discussions

10. Round-table discussions on drafts developed by individual groups

11. Adoption of conclusions and recommendations

APPENDIX 1.B

Welcoming address by Mr He Changchui, Assistant Director-General and FAO Regional Representative for Asia and the Pacific

Ladies and Gentlemen,
Welcome to Bangkok.

I would like to welcome all of you, on behalf of the Organization, to this Expert Consultation and thank you for providing your expertise in the upcoming days of this Consultation on the important topic of deep-sea fisheries.

As you may know, there has been increasing concern on the part of many Member Nations and related international organizations over the conservation and management, and governance of deep-sea fisheries. This concern stems largely from the recognition that deepwater fisheries, as a result of technological development and market demand, are, in many areas, being exploited at increasingly unsustainable rates and in some cases with considerable damage to benthic habitats. In addition, there has been emerging recognition that existing regulatory regimes, based primarily on the 1982 Law of the Sea Agreement, are proving incapable of effectively regulating these fisheries. This is especially the case for deep-sea fisheries which concern high-seas stocks.

The FAO Committee on Fisheries, COFI, first raised the issue of management and governance of deep-sea fisheries and related issues at its twenty-fifth session, in February 2003. On this occasion, "*several Members referred to the need for the improved management of deep-sea fisheries, especially those that are discrete high-seas stocks and noted that international law requires further development in this regard*". The concept for a Conference on the management and governance of deep-sea fisheries was brought to the floor of the Session and supported by the Committee.

The DEEP SEA 2003 Conference was then initiated and hosted by Australia and New Zealand. This conference began to address the paucity of information available and insufficient management and governance regimes of deep-sea fisheries.

Again, at the twenty-sixth meeting of COFI in March 2005, the issue of deep-sea fisheries was raised. There the Committee recommended that FAO undertake further work on deep-seas through the following activities to:

a) collect and collate information concerning past and present deepwater fishing activities;

(b) undertake an inventory of deepwater stocks and an assessment of the effects of fishing on deepwater fish populations and their ecosystems;

(c) convene technical meetings to develop a code of practice/technical guidelines; and

(d) review the legal framework needed to support conservation and management of deepwater fisheries.

With the financial support of the Government of Japan, FAO initiated a new project in late 2005 which, *inter alia*, aims at addressing some of these issues. This Expert Consultation constitutes the first major activity under the deep-sea fisheries component of this project. Future activities will include further reviews and analyses of deep-sea fisheries and their ecosystems, a technical consultation on deep-sea fisheries, and finally the development of technical guidelines for the conservation and management of deep-sea fisheries and ecosystems.

The overall objective of the current project, of which this Expert Consultation is an important component, is to provide benefits to FAO members in the form of enhanced information, methodologies and guidelines for better management of deep-sea fisheries.

Your task in the coming days will be to participate in and add to the objective of this Expert Consultation by furthering information available on management aspects of deepwater fisheries. As such, the Consultation will address and analyze four main aspects of deep-sea fisheries management:

- Initially, options for management, including the creation of protected areas, will be discussed.
- Later sessions will focus on issues related to regulation and compliance, and guidance for compatible options within EEZs.

I would like to thank you all for taking the time to assist FAO with this task and for providing your wisdom and insights. I wish you a productive experience in the coming days and look forward with interest to the results of your work.

For those of you who are not familiar with FAO rules and procedures, I should perhaps clarify your role in this Expert Consultation. Each of you is attending this Consultation in your individual capacity, and not as a representative of your government or organization. In this line, there is no difference in status between those of you who work with government and those of you who work with a private or non-governmental entity; more importantly, all of you are encouraged to freely share your frank views and comments, as well as provide your intellectual inputs to the various subject matters identified for this consultation.

I finally wish to take this opportunity, on behalf of the Organization and of the Fisheries Department, to thank the Government of Japan for their support of this important work and for providing the funds necessary for convening this Expert Consultation.

Thank you very much, Ladies and Gentlemen, for your attention.

APPENDIX 1.C

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