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# *Constraints to the Sustainability of Deep Sea Fisheries beyond National Jurisdiction*

## *Summary and Recommendations*

The prerequisites for sustainable management of deep sea bottom fisheries have so far been lacking. As is highlighted in COFI/2005/6 on Deep Sea Fisheries, problems include significant gaps in information on the biology of deep sea fish species, the diversity and ecology of deep sea ecosystems as well as on the location and amounts of catch, bycatch, and fishing effort associated with deep sea fisheries. Information is particularly poor for deep sea fisheries conducted on the high seas. Exacerbating these gaps are deficiencies in decision-making, governance, implementation of management and conservation measures, and compliance with existing requirements for sustainable and responsible fisheries. Participants at DEEP SEA 2003[1] agreed that rapid action is required to address these gaps if remaining deep sea fishery resources are to be managed on a sustainable basis and deep sea biodiversity protected. Lessons from past mistakes must be applied and current management approaches changed.

This briefing summarizes recent information on the biology of seamounts and cold water coral communities--the deep sea environments most at risk of damage from bottom trawling both within and beyond national jurisdiction. Because bottom trawling and its effects on deep sea biodiversity are regulated in only a few areas on the high seas, this briefing focuses on problems related to bottom trawling beyond national jurisdiction. It provides a legal analysis of the consistency of high seas bottom trawling with the requirements of international law as reflected in the UN Convention on the Law of the Sea (UNCLOS), the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (Fish Stocks Agreement or FSA) as it relates to straddling deep sea fish stocks, and the Convention on Biological Diversity (CBD), as well as the principles of the FAO Code of Conduct for Responsible Fisheries (Code of Conduct) and the FAO International Plan of Action on Illegal, Unreported and Unregulated Fishing (IPOA IUU Fishing).

Our legal analysis of high sea deepwater bottom trawling concludes that it falls short in several significant ways from existing legal requirements. This has major implications for the sustainable management of deep sea fisheries and biodiversity. In particular, unregulated high seas deepwater bottom trawl fisheries are not

presently conducted in a manner consistent with State responsibility for the conservation of living marine resources under international law.

The UN General Assembly in November 2004 called on States, RFMOs and relevant international bodies to take urgent action to address destructive fishing practices, including bottom trawling that has adverse impacts on seamounts and cold water corals beyond national jurisdiction.

As is emphasized in COFI 2005/6: "Many actions are required if deepwater fisheries are to contribute to global food security, social welfare and maintenance of biodiversity and the quality of fish habitats" (para. 14). The list of "Future Possible Actions" provides a good foundation for action (paras. 14-24).

In this briefing, IUCN expands that list and highlights steps critical to addressing the gaps and deficiencies in information, governance and management necessary to protect vulnerable ecosystems and ensure sustainable deepwater bottom fisheries beyond national jurisdiction.

***IUCN recommends that COFI:***

- ***Agree to address the information insufficiencies outlined in COFI/2005/6 regarding deep sea fisheries through a globally-coordinated effort to document these fisheries and their effects, in collaboration with relevant international and regional organizations.***

- ***Agree to ensure that deep sea bottom fishing is managed on an ecosystem and precautionary basis that ensures sustainable fisheries and biodiversity protection, and to develop and apply environmentally responsible gear and practices. Any FAO code of practice for deep sea fisheries suggested in COFI/2005/6 should reflect these principles.***

- ***Agree to advance the FAO Strategy for Improving Information on Status and Trends of Capture Fisheries, including its application to deep sea fisheries, through working with members, RFMOs and other international bodies in order to improve knowledge and understanding of fishery status and trends and strengthen management and conservation capabilities so that all States benefit from the achievement of precautionary and ecosystem approaches to fisheries management.***

- ***Endorse the elaboration of technical guidelines on the testing and use of MPAs in fisheries management contemplated in COFI/2005/8. These should be developed through consultations with members and relevant international organizations and promote the establishment of areas where bottom fishing activities are excluded or strictly managed to protect biodiversity and/or maintain ecosystem integrity.***

- ***Assist coastal nations with extended continental margins beyond 200 n.m., in consultation with relevant RFMOs, to identify measures available to the coastal State to prevent or mitigate damage resulting from high seas bottom trawl fishing to sedentary species subject to coastal State resource rights on the continental margin beyond 200 n.m.. The technical guidelines contemplated on MPAs in fisheries management could play a role.***

- *Establish a process for scientific oversight of fishery status and trends information, as suggested in the FAO Strategy for Improving Information on Status and Trends of Capture Fisheries (para. 34), to provide quality assurance of information and assessment methods used by RFMOs, including precautionary and risk-averse approaches.*

- *Call on States whose flag vessels fish on the high seas to require under national legislation that these vessels and related fishing industries report fully on their activities. Further measures could be considered to strengthen the port state role in reporting all landed catch and details about the vessels involved. The Secretariat should be requested, in collaboration with RFMOs and other bodies, to play a more active role in identifying discrepancies in reporting on high seas catch and import/export data, with particular attention to deep sea fisheries.*

*<u>In addition, IUCN recommends that COFI call on States, RFMOs and relevant international organizations to:</u>*

*Address deficiencies in governance outlined in COFI/2005/6 by:*

- *Extending the relevant provisions of the 1995 UN FSA to cover all high seas fisheries, and develop additional technical annexes on: 1) deepwater fisheries; 2) new and exploratory fisheries; and 3) protected areas for fisheries and biodiversity conservation;*

- *Ensuring that relevant RFMOs expand and/or update their mandate or new RFMOs or arrangements are established to manage high seas deep sea fisheries in a manner that fully incorporates inter alia, the ecosystem-based and precautionary requirements of the FSA, CBD, the FAO Code of Conduct, and other relevant agreements;*

- *Undertaking a systematic review of all RFMO mandates and measures to ensure that they reflect and implement the provisions of the FSA, CBD and 1993 Compliance Agreement as well as the FAO Code and IPOAs (precaution, ecosystem approaches; effective compliance and enforcement, and other measures);*

- *Eliminating the problems of illegal, unregulated and unreported high seas bottom fishing, including through strengthening of flag state and port state jurisdiction and comprehensively addressing the issue of vessels flying flags of convenience.*

*Adopt precautionary measures by:*

- *Immediately suspending high seas bottom trawling in areas where there is no RFMO in place with the competence to manage deep sea fish stocks and conserve biological diversity until the steps outlined above are in place;*

- *Suspending high seas bottom trawling in other areas if the steps outlined above are not in place by December 2006.*

# *BACKGROUND AND RATIONALES*

## THE BIODIVERSITY OF SEAMOUNT AND COLD WATER CORAL COMMUNITIES

The deep sea is a major reservoir of the earth's biodiversity. Estimates of the numbers of species inhabiting this area range between 500,000 to 10 million species. Some have suggested that it could range as high as 100 million species[2]. The 'deep sea' is generally considered to be that part of the ocean which begins at 200-400 meters below the ocean surface and extends to the seafloor beyond the continental shelf and includes the slope and rise of the continental margin, the abyssal plain, as well as mid-ocean ridges, seamounts and plateaus rising from the deep ocean floor. Much of this habitat lies beyond 200 nautical miles from shore[3] .

### Biodiversity of seamounts

Although relatively few seamounts have been comprehensively sampled, recent research has shown that seamounts are hot spots for the evolution of new species, refuges for ancient species, and stepping-stones for species to spread across ocean basins[4]. Seamounts are isolated islands or island chains beneath the surface of the sea. According to the latest estimates, there may be as many as 50,000 seamounts in the Pacific Ocean over 1000 meters high and possibly up to 100,000 globally[5]. As deep currents sweep past seamounts they accelerate, serving to concentrate plankton and carry nutrients up from the ocean floor. This upwelling turns these features into important feeding, breeding and spawning sites for a wide variety of bottom dwelling and pelagic species, including orange roughy, oreos, swordfish, tunas, sharks, whales, sea turtles, and seabirds.

The hard surface of seamounts provides habitat for a wide variety of species, including suspension feeding corals (gorgonian, scleratinian and antipatharian), crinoids, hydroids, ophiuoids, and sponges[6]. Spectacular biological habitats in the form of coral reefs may form on seamounts, providing a wealth of habitats similar to those found on shallow-water tropical coral reefs.

The fauna of seamounts can be highly unique and may have a very limited distribution restricted to a single geographic region, a seamount chain, or even a single seamount location. Rates of endemism are high, ranging from 35% on seamounts off Tasmania, 36% for seamounts on the Norfolk Ridge; 31% on the Lord Howe Island seamounts, and 44% for fishes and 52% for invertebrates on the Nasca and Sala-y-Gomez chains off Chile[7]. Research suggests that these high rates are not just an artifact due to limited sampling, for adjacent seamounts in New Caledonia have been found to share an average of just 21% of their species, and seamounts on separate ridges approximately 1000 km apart in the Tasman and Coral Seas have only 4% of their species in common[8].

### Biodiversity of cold water coral communities

Recent research has also revealed exciting discoveries about the number and variety of coral species living in the deep sea. These corals can form extensive reefs, such as the *Lophelia* reef off Rost Island, in Lofoten, Norway. This reef, which was discovered only in June 2002, is over 40 kilometers long and 3 kilometers wide, and is thought to be 8,500 years old[9].

Cold water coral reefs can occur in waters at depths between 39m and 1500m+ on continental slopes, submarine plateaus, ridges and seamounts. Cold water corals and/or coral reefs are now known to occur in 41 countries, including Angola, Australia, Brazil, Canada, Chile, Columbia, Iceland, Ireland, Japan, Mauritania, New Zealand, Norway, Russia, the Seychelles, South Africa, Sweden, the United Kingdom, the United States, the Western Sahara as well as on the seabed beyond national jurisdiction[10]. Growth rates are extremely slow for cold water coral reefs, at about 4-25 mm a year, compared to up to 150 mm a year for warm water coral reefs[11].

Like their tropical cousins, cold water coral reefs support rich and diverse assemblages of marine life distinct from the surrounding seafloor. For example, *Lophelia* coral reefs in cold waters of the Northeast Atlantic provide habitat for over 1,300 species of invertebrates. Cold water coral reefs host large numbers of commercially important fish species, including groupers, redfish, pollock, tusk, ling, wolfish, lemon sole, monkfish, grenadiers, orange roughy and oreos[12].

The biological characteristics of most cold water species render them particularly sensitive to human disturbance and exploitation; cold water corals and sponges typically are slow-growing, long-lived and fragile. The slow growth, longevity, late sexual maturity, and restricted distribution of many of the species associated with seamount ecosystems make them particularly vulnerable to human impacts and the risk of extinction. Concerns over the impact of fishing and the potential loss of this biodiversity are amplified by the limited information about the taxonomy, biology and ecology of most of the species found in deep ocean areas.

## IMPACTS OF BOTTOM FISHERIES ON VULNERABLE DEEP SEA ECOSYSTEMS

Large-scale commercial fishing for bottom dwelling species in deep sea areas began in the 1960s for pelagic armourhead and other seamount-associated species. Over the course of subsequent decades, many deep sea bottom fisheries, particularly those on seamounts, came to be characterized as 'serial depletion' fisheries as one population after another of commercially exploited deep water species were depleted or collapsed. By 2002, most shallow seamounts (<800m below the water's surface) had already experienced some degree of fishing pressure[13]. Larger vessels, more powerful winches, stronger cables and rockhopper trawls have greatly expanded the reach of bottom trawl fishing, which can now reach depths of 2000 meters.

The environmental or ecosystem impacts of bottom fishing in the deep sea are threefold. One is the impact of the extensive 'bycatch' of non-target or unwanted species. Most of these species do not survive the transition from the deep. The second is the removal of large quantities of biomass (fish populations) from the food web of 'food-poor' or low energy environments characteristic of the deep sea. There is concern that loss of large quantities of fish biomass (and their wastes) could significantly disrupt food web and trophic level interactions amongst bottom dwelling communities[14]. The third is the physical impact of fishing on ocean bottom habitats and ecosystems; primarily coral, sponge and other filter feeding species that often provide the basic structure of seamount and other deep sea ecosystems.

The three major gear types used in deep sea bottom fishing – gillnets, longlines, and bottom trawls -- are all believed to have some degree of impact on corals and other bottom dwelling organisms. Bottom trawling, however, is considered to be by far the most damaging and is the most common gear used in deep sea bottom

fishing throughout the world. Bottom trawling often involves taking high quantities of bycatch of numerous non-target species; while fishing, bottom trawl ships drag the ocean floor with a heavily weighted net designed to scoop up large schools of fish. Deeper trawling and rougher seabeds require heavier trawl doors, cables and/or ropes to keep the nets open and on the bottom. The trawl doors alone, for example, can weigh up to five tons each[15].

Studies have shown that bottom trawling has turned cold water corals and seamount surfaces into rubble. Considerable damage to cold water coral communities has been documented off both coasts of North America, off Europe from Scandinavia to Northern Spain, and on seamounts near Australia and New Zealand[16]. Photographic transects conducted south of Tasmania in the Southwest Pacific showed that 95% of the bottom was bare rock on a heavily fished seamount compared with about 10% bare rock on the most comparable unfished seamount[17]. Video and photographic surveys have revealed deep parallel grooves of pulverized coral ploughed by trawl doors. Norwegian scientists estimate that up to half of their continental shelf cold water reefs have already been damaged or destroyed by fishing[18].

The bycatch of corals can also exceed the quantity of fish caught. As reported in Gianni (2004)[19]:

> "Large quantities of corals were taken as bycatch in the first year of the trawl fisheries for orange roughy on seamounts on the South Tasman Rise. The fishery targeted orange roughy on a ridge system and five small seamounts or 'hills' in an area straddling the boundary of the Australian EEZ and international waters south of Tasmania. Observers estimated a bycatch of approximately 1.6 tons of coral for each hour of towing a trawl net during the 1997-1998 fishing season - the first year of the fishery. They estimated a total of 1,762 tons of coral were brought up in the trawl nets in the 165 tows observed - averaging over 10 tons per tow. Observer coverage was estimated to be approximately 14.5% of the total number of tows in the fishery in the first year. Extrapolating from these figures, the fishery may have taken over 10,000 tons of coral in the first year of the fishery. This figure would not include coral damaged but not brought to the surface in the net. By contrast, the catch of orange roughy in this fishery was approximately 4,000 tons during the same period. The authors state that the trawl gear used in the fishery is "typically heavy duty, designed to cope with the rough and hard bottom often found on seamounts"[20].

The recovery of these deep sea corals and sponges that may live for centuries is likely to be extremely slow – and so, too, the many species that depend upon them[21].

## SUSTAINABILITY OF DEEP SEA FISHERIES

There are also significant questions about the sustainability of deep sea fisheries themselves[22]. Exploited deepwater species generally exhibit life history characteristics markedly different from most shallow water species: extreme longevity, late age of maturity, slow growth, and low fecundity.

> Orange roughy may live up to 125 years, reach reproductive maturity around 25 to 30 years of age, and undergo extended periods of very low recruitment (in the order of a decade or more)[23]. It has been estimated

that sustainable yields may be 1-2% per year of the pre-exploitation biomass, and that the rate of rebuilding after depletion may be as low as 2.5% of virgin biomass per year. These characteristics added to the fact that the species form large spawning aggregations-which most fishing operation target- near banks, pinnacles and canyons make the species very vulnerable to over-exploitation. [24]

Deep water sharks caught as both targets and bycatch may be even more vulnerable. Scientists now realize that over 35% of all shark species live only in the deep sea, with many species endemic to relatively small areas and very restricted depth ranges. The conclusions of a workshop held in conjunction with DEEP SEAS 2003 indicated that deep water sharks may be more vulnerable to overexploitation than perhaps any other species[25].

Cold water corals grow at extremely slowly, at rates between 4-25 mm a year. Thus they present the same life history attributes as other deep water species and therefore are highly vulnerable to overexploitation[26]. Red, pink, gold, black and bamboo corals have all been collected from the Mediterranean and the Pacific in substantial quantities. After their depletion in the Mediterranean Sea, coral collectors shifted to the North Pacific Ocean once they were discovered there in the mid 1960s.

These life history characteristics coupled with the intense exploitation of seamounts' valuable resources has led to depletion and collapse of a variety of fish stocks. Already there is considerable evidence that many of these fisheries are more similar to "mining" operations than to sustainable fisheries, with targeted fish stocks showing signs of overexploitation within a short period from the beginning of the fishery. Examples of the rapid depletion and collapse of deep sea fisheries come from around the world.

The populations of the rock lobster *Jasus tristani* on the Vema seamount crashed due to a combination of overfishing and unpredictable larval recruitment[27].

Fisheries of the pelagic armourhead *Pseudopentaceros wheeleri* over the southern Emperor seamounts and seamounts in the northern Hawaiian Ridge came to commercial extinction within 10 years of their discovery[28].

The orange roughy *Hoplostethus atlanticus* fisheries on seamounts off the coasts of New Zealand and Australia, where new discoveries of stocks are typically fished down to 15-30 per cent of their initial biomass, and sometimes lower, within 5-10 years[29].

Spawning aggregations of orange roughy in ICES subarea VI in the Northwest Atlantic quickly developed in 1991, harvesting about 3,500 tons. By 1995, the orange roughy landings declined to less than 200 tons per annum[30].

Fishing effort for deep water species in the Northeast Atlantic has largely been uncontrolled and now most deep water stocks are "outside safe biological limits". To address this situation, the International Council for Exploration of the Seas (ICES) recommended (in both 2000 and 2001) an immediate reduction in fishing effort on these stocks. As well, ICES stated that "fishing should not be allowed to expand faster than the acquisition of information necessary to provide a basis for sustainable exploitation and

advised that "New fisheries should be permitted only when fisheries expand very slowly and are accompanied by programs to collect data which allow evaluation of stock status". Only in 2004 did the North East Atlantic Fisheries Commission (NEAFC) agree to reduce fishing effort by 30%.

A mixed species deep sea shark trawl fishery off the coast of New South Wales caused the rapid depletion of some of the most biologically-vulnerable species targeted. For example, an endemic species of deepwater gulper shark (*Centrophorus harrissoni*) is now Critically Endangered (www.redlist.org) following 98% depletion in this fishery, with several other regional populations of deepwater sharks similarly affected[31].

A recent example is the fishery which developed on seamounts in the international waters of the Southwest Indian Ocean. In 1999, orange roughy stocks were discovered in the area by several vessels. By 2000, 40 large-scale deep sea trawlers from over a dozen countries were fishing in the region and together caught almost 40,000 tons of deep sea fish, primarily orange roughy and alfonsinos. The catch dropped to some 8,000 tonnes in 2001 and by 2002 only a few vessels remained in the fishery[32].

A 2003 analysis conducted by WWF and Traffic of orange roughy fisheries worldwide indicates that management has generally failed to ensure their sustainability. Of the 30 orange roughy fisheries surveyed, nearly half had been fished to below 30% of their pre-fishing biomass. Only one was found to be above this level. The status of half of the stocks was unknown, either because stock assessments had not been carried out or because the uncertainties were so great that the assessments proved inconclusive[33].

In sum, the past thirty years of deep sea bottom fishing has repeated a pattern of exploration, discovery, exploitation, and rapid depletion. Management responses have been unable to keep pace. In response to the rapid development of fishing in the Southwest Indian Ocean, a number of countries attempted to establish a regional fisheries management organization. Negotiations are still underway; in the meantime, the fisheries have largely collapsed and the fleets have moved on[34]. As deep sea fish stocks within national waters are depleted and/or increasing restrictions are placed on fishers within national jurisdiction, this type of fishing is expanding into previously unfished high seas areas. There are already signs that exploratory fishing on the high seas has commenced in the Central Atlantic and Eastern Indian Oceans, and possibly in the North and Central Pacific[35].

Most deep sea bottom trawl fishing still occurs within the 200 n.m EEZ, where States are able to exercise direct control. On the high seas - the global commons - such bottom trawl fishing is expanding and will most likely accelerate in the years to come. The current amount and value of high seas bottom trawl fisheries is small, representing only about 0.2-0.25% of global marine fish catch in 2001 (the latest year for which data are available). Its overall value is not likely to exceed $300-400 million USD annually, or 0.5% of the estimated value of global marine fish catch in 2001 ($75 billion USD). Fishing vessels flagged to only 11 countries took approximately 95% of the reported high sea bottom trawl catch in 2001. All of these, except Japan (and possibly Denmark on behalf of the Faeroe Islands) have ratified or will soon ratify the UN Fish Stocks Agreement[36]. Effective management regimes consistent with the relevant provisions of the FSA and the FAO Code of Conduct should be in place before these fisheries are allowed to take place or expand in the high seas.

## GOVERNANCE AND MANAGEMENT GAPS AND DEFICIENCIES

In November 2004, the UN General Assembly adopted in its Oceans Resolution[37], a call upon States and international organizations to urgently take action to address, in accordance with international law, destructive practices that have adverse impacts on marine biodiversity and ecosystems, including seamounts, hydrothermal vents and cold-water corals. It also created an Open-ended Informal Working Group to study issues related to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction[38].

In its Sustainable Fisheries resolution[39], the General Assembly called upon States to take action urgently, and consider on a case-by-case basis, and on a scientific basis, including the application of the precautionary approach, the interim prohibition of destructive fishing practices, including bottom-trawling that has adverse impacts on vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals located beyond national jurisdiction, until such time as appropriate conservation and management measures have been adopted in accordance with international law. The General Assembly also called upon RFMOs with competence to regulate bottom fisheries to urgently adopt measures to address the impacts of these destructive fishing practices, and called upon members of those without such competence to expand the competence of the RFMO. In addition, it called for new RFMOs to be established where none exists. The UN Secretary General is to report on measures taken to implement the resolution in his annual report to the UN General Assembly, and progress will be reviewed within two years (paras. 66-71).

These UN General Assembly resolutions should result in progress to address the significant governance gaps and deficiencies with relation to high seas bottom trawl fisheries. However, there are several areas where these resolutions fall short of what is required to ensure prompt and effective action.

Firstly, it enables a practice to persist which does not appear to meet the duties of States for the conservation and sustainable use of marine living resources under UNCLOS, the FSA with respect to straddling fish stocks, and the CBD, nor with the principles of the IPOA IUU Fishing and the Code of Conduct, whose ten year anniversary is being celebrated at this meeting. Secondly, it provides little incentive for conservation-minded States to act while others can continue to fish unsustainably. Thirdly, the expansion of RFMO mandates to cover deep sea fisheries or the establishment of new RFMOs will proceed only as quickly as the least reluctant participant is willing to move. Additionally (as this list could go on) our vast ignorance of deep sea environments means that a case-by-case approach to protecting only specific areas known to be vulnerable to bottom trawling means that many seamounts and cold water coral reefs will be destroyed before they can be identified and appropriate regulations put in place.

These shortcomings should raise serious questions as to whether deepwater bottom trawl fisheries, particularly in areas lacking an RFMO with competence to manage them, should be allowed to continue in the absence of an effective and sustainable management and governance regime.

Gaps in the high seas governance regime have permitted and will continue to permit serial depletion of deepwater fish stocks and destruction of biodiversity. The section below compares current high seas bottom trawling practices with legal requirements and standards under the Code to prevent overfishing, to cooperate to

manage fish stocks, to report catch data, to control new and exploratory fisheries, to develop and apply environmentally safe gear and to protect biodiversity. Sections discussing high seas bottom trawling impacts on coastal State continental margins beyond 200 n.m. and needs for research and assessment follow.

## *Serial depletion*

The serial depletion of high seas deepwater fish stocks contravenes the duty of all States to take necessary measures so that their nationals conserve living resources of the high seas or cooperate with other States in so doing (UNCLOS, art. 117). Bottom trawl fisheries for straddling stocks are subject also to the FSA. The responsibilities of FSA States parties to conduct sustainable fisheries are spelled out in its general principles, which include ecosystem-based management and the precautionary approach (FSA, arts. 5 and 6).

The RFMOs presently competent to regulate high seas bottom fisheries are NEAFC, Northwest Atlantic Fisheries Organization (NAFO), the Commission for the Conservation of Antarctic Living Marine Resources (CCAMLR), the Southeast Atlantic Fisheries Organization (SEAFO) and the General Fisheries Commission for the Mediterranean (GFCM). Of these, SEAFO is still not operational. NAFO has yet to take any measures to regulate the impacts of bottom trawling on habitats or biodiversity. The GFCM and NEAFC have recently adopted measures relating to bottom fisheries[40]. In late February, 2005 the GFCM banned bottom trawling (including towed dredges) at depths beyond 1000 m in the Mediterranean, but has yet to address bottom trawling impacts in waters less than 1000 m. In November 2004 NEAFC called for a 30% reduction of effort, four years after warnings by ICES that all deepwater fisheries were *beyond safe biological limits*. NEAFC also closed five seamounts and a part of the mid-Atlantic Ridge to fishing to protect vulnerable bottom habitats for three years but rejected two others. Only CCAMLR has long had measures to prevent overfishing, limit bycatch, protect bottom habitat, control new and exploratory fisheries, and collect data to assess impacts.

*In areas where serial depletion has been permitted to occur notwithstanding the existence of a RFMO with legal responsibility for managing deep sea fish stocks, the performance of the RFMO should be reviewed by FAO in consultation with DOALOS and the CBD Secretariat to ascertain the reasons for failure to implement the requirements of UNCLOS, the FSA, the CBD and the Code of Conduct. Such a review should consider whether conservation and management measures take fully into account the interdependence of fish stocks and any generally recommended international minimum standards, regional or global, as well as effects on species associated with or dependent upon harvested species so that their reproduction is not seriously threatened (UNCLOS, art. 119). Where these are straddling stock fisheries, articles 5 and 6 and Annex II of the FSA set out the basic guidance. The Review should incorporate recommendations regarding specific steps needed to comply with the instruments described above. To ensure prompt action, bottom trawl fishing within the area covered by the RFMO should be subject to an interim prohibition if appropriate conservation measures have not been adopted by December 2006.*

## *Unregulated High Seas Bottom Trawl Fishing*

States whose nationals exploit identical living resources, or different living resources in the same area, must enter into negotiations with a view to taking the measures necessary for the conservation of the resources concerned, and

cooperate in establishing RFMOs for this purpose (UNCLOS, art. 118). Regarding bottom trawl fisheries for straddling stocks, States parties to the FSA are bound to take action in compliance with the provisions of the UN Fish Stocks Agreement to establish RFMOs or arrangements to agree conservation and management measures[41].

Numerous UN General Assembly resolutions and other international instruments have called for the elimination of unregulated fishing. The FAO International Plan of Action on Illegal, Unreported and Unregulated (IUU) Fishing (2001) defines unregulated fishing as that which takes place in areas or for fish stocks in relation to which there are no applicable conservation or management measures and where the fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law[42].

Vast areas of the ocean lack coverage by an RFMO with the competence to manage deepwater fisheries on the high seas. The entire Indian and Pacific Oceans, as well as the central and southwest Atlantic are without effective regulatory mechanisms to manage deepwater fisheries or protect deep sea biodiversity beyond national jurisdiction[43]. The history of serial depletion and biodiversity destruction in most high seas deepwater fisheries indicates that it is highly inconsistent with the State responsibility for the conservation of living marine resources and biodiversity protection under international law.

This situation creates an urgent need for action. As was stated by Molenaar (2004)[44]:

> "It is submitted that unregulated fishing in the sense of fishing in the absence of specific (international) regulation but inconsistent with broader state responsibilities, or even legal obligations, is at the moment actually a more serious problem for deep sea fisheries."…. "In areas where a need [for regulation] does arise due to the commencement of a deep sea fishery, the characteristics of deep sea fisheries are such that they may no longer exist once the international institutions are operational."

*In accordance with UNCLOS art. 118, States engaged in high seas bottom fishing for the same stocks or in the same area should set a deadline of December 2005 for agreement on sustainable fisheries management. In keeping with precautionary and ecosystem-based approaches, bottom trawl fishing in such areas should not occur until appropriate management regimes are in place.*

As it makes little sense to have different standards apply to deep sea fish stocks that straddle the high seas and those that are fished further offshore, the same FSA provisions should be made applicable to discrete high sea fish stocks as well. *States parties to the FSA, reinforced by the UN General Assembly, could decide to formally extend the relevant provisions of the FSA to cover high seas fisheries for stocks that are neither straddling nor highly migratory. This could be done, for example, through an annex or protocol to be adopted at the FSA review conference in 2006. This instrument should ensure full application of FSA principles to all high seas deepwater fisheries so that direct and indirect effects of fishing are taken into account on an ecosystem and precautionary basis. Further elaboration of the FSA to guide new or exploratory fisheries and the establishment of protected areas is suggested in sections below.*

## *Unreported High Seas Bottom Trawl Fishing*

All States are required to contribute and exchange regularly all available scientific information, catch and fishing effort statistics, and other data relevant for the conservation of fish stocks through competent regional and global bodies (UNCLOS, art. 119.2). The FSA similarly requires States to "collect and share, in a timely manner, complete and accurate data concerning fishing activities on, inter alia, vessel position, catch of target and non-target species and fishing effort, as set out in Annex I" (FSA art, 5(j)). The FAO IPOA on IUU Fishing defines unreported fishing as fishing activities that are not reported or misreported to relevant national authorities or a competent RFMO, in contravention of national law or RFMO reporting procedures, respectively. It does not cover the situation where there is no competent RFMO or relevant national law.

COFI/2005/6 notes serious deficiencies in data on deep sea fishery catches, species composition, bycatch and the location of fishing effort (para. 2). There are also significant discrepancies in existing statistics on high seas bottom trawl fisheries. For example, in the Northeast Atlantic, ICES has repeatedly voiced concern that the landings statistics that are available may not reflect the true scale of the recent fishing activity, especially in waters outside EEZs[45]. There are also serious problems with under-reporting of high seas bottom trawl catches and difficulties in accounting for catches made by unregulated fishing.[46] When data are lacking for a substantial portion of the catch, this undermines the basis for effective and sustainable management of the fishery.

Unreported fishing is the subject of several ongoing international initiatives addressing deficiencies regarding Illegal, Unregulated and Unreported (IUU) fishing. These efforts should clearly be supported.

*At the same time, COFI should call on States whose flag vessels fish on the high seas to require under national legislation that these vessels and related fishing industries report fully on their activities, with appropriate sanctions for non-compliance. Further measures could be considered to strengthen the port state role in reporting all landed catch and details about the vessels involved. The FAO Secretariat should be requested, in collaboration with RFMOs and other bodies, to play a more active role in identifying discrepancies in reporting on high seas catch and import/export data, with particular attention to deep sea fisheries. It is also essential for FAO to collate and make available to the United Nations and other relevant fora data on high seas bottom trawling, including catch, by catch, areas fished, effort, number of vessels, and flags of those vessels.*

## *Absence of Regulations to Guide New and Exploratory Fisheries*

The FSA also calls for states and RFMOs to apply and adopt rules to guide new and exploratory fisheries. It specifically calls for States to "adopt as soon as possible cautious conservation and management measures, including, inter alia, catch limits and effort limits. Such measures shall remain in force until there are sufficient data to allow assessment of the impact of the fisheries on the long-term sustainability of the stocks, whereupon conservation and management measures based on that assessment shall be implemented. The latter measures shall, if appropriate, allow for the gradual development of the fisheries" (Art. 6.6).

However, even in the Northeast Atlantic where an RFMO with the competence to manage deep water fisheries exists, such fisheries have been allowed to develop in

the absence of information and before regulations are in place. As stated by the ICES Advisory Committee on Fisheries Management in 2004:

> ”Fisheries on deepwater species have developed rapidly and the resources which they exploit are generally especially vulnerable to overfishing. Within the ICES area species/stocks have been depleted before appropriate management measures have been implemented.”

In conformity with the FSA and the Code of Conduct, new and exploratory fisheries should be carefully designed and monitored to ensure that they develop gradually and only as sufficient information is available to make well-founded judgments about potential sustainable yield and the potential impacts of the fishery on other ecosystem components. They may be controlled to test different fishing models (e.g., modified gear and practices, closed areas and seasons).

The measures adopted by CCAMLR for the Southern Ocean set forth a detailed approach calculated to produce the necessary information from operators engaged in an exploratory fishery. This includes preparation of a data collection plan to obtain the necessary data; restrictions on catch, effort and fishing gear; and a precautionary limit on harvests that is set slightly above that necessary to obtain the information specified in the data collection plan. Advance notification and detailed reporting is required by those participating in the fishery, and a scientific observer is required on each vessel.

There is reason to believe that even the most careful and precautionary approach to exploratory fishing may be insufficient to prevent overfishing and depletion of certain deep sea fish stocks, as illustrated by the Namibian orange roughy experience in the 1990s[47]. This underscores the importance of the assessment, described above, of whether any deep sea fisheries are sustainable.

*An agreed design for new or exploratory bottom fisheries that is precautionary and ecosystem-based, drawing on the CCAMLR model, should be developed and adopted as an annex to the FSA to inform regional agreements and arrangements.*

## *Destructive Fishing Gear and Practices*

Regulating the design, type, size, and amount of fishing gear and where it may be deployed has long been a feature of national and regional fishery management measures. To date these measures have largely been applied to conserve target fish stocks, but such measures are also required to avoid destructive by-catch and incidental take of non-target species as well as habitat damage.

Recent international fisheries instruments call for use of selective, environmentally-safe fishing gear and practices and for measures that minimize the catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species, in particular endangered species. (FSA, art. 5(f); FAO Code of Conduct, art. 6.6). The FSA details requirements to "assess the impact of fishing [on] species belonging to the same ecosystem or associated with or dependent upon the target stocks” (FSA art. 5(d)) and "adopt plans which are necessary to ensure the conservation of such species and to protect habitats of special concern” (FSA art. 6.3(d)). It further calls for States to minimize the impact of fishing through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques” (FSA art. 5(f)).

*Selective, environmentally-safe fishing gear and practices should be in place and measures adopted that minimize the catch of non-target species, both fish and non-fish species, and minimize impacts on associated or dependent species and habitats. Agreed designs for precautionary, exploratory bottom fisheries should include the development and testing of selective, environmentally-safe fishing gear and practices.*

***Absence of Regulations to Protect Biodiversity***

Under UNCLOS, States have the obligation to protect and preserve the marine environment (art. 192). This includes the obligation to take measures necessary to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life (art 194.5).

Through the Convention on Biological Diversity, Parties (188 States are Parties) specifically take on "the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction" (art. 3). Parties are expected to identify, monitor, provide data on and manage processes and activities carried out under their jurisdiction or control which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity beyond national jurisdiction (art. 7(c) and 8(l)). They are also to cooperate directly or though competent international organizations for the conservation and sustainable use of biological diversity in areas beyond national jurisdiction (art. 5).

In 2002, Governments agreed in the World Summit on Sustainable Development's Joint Plan of Implementation to develop and facilitate the use of diverse approaches and tools, including the *elimination of destructive practices*, the establishment of marine protected areas (MPAs) consistent with international law and based on scientific information, including *representative networks by 2012* and time/area closures for the protection of nursery grounds and periods (para. 32(c)).

The CBD/COP7 has encouraged the development of national management frameworks for marine and coastal biodiversity (Dec. VII/5, paras. 20-28). This framework is to comprise:

i. sustainable management practices and actions to protect biodiversity over the wider marine and coastal environment, including integrated networks of marine and coastal protected areas consisting of:
ii. areas where extractive uses may be allowed and threats are managed for the purpose of biodiversity conservation and/or sustainable use, such as controls on the removal of habitat-forming species or particular fishing methods; and
iii. areas where extractive uses are excluded and other significant human pressures are removed or minimized, in order to maintain or restore the integrity, structure and functioning of ecosystems.

Specifically with respect to high seas fisheries, a similar framework should be developed so that sustainable management practices that also protect biodiversity prevail throughout the high seas. These should be supplemented by closed areas where no extractive uses are permitted to preserve or restore baseline biodiversity values, as well as strictly managed areas where some uses may be permitted. However, it is clear that high seas bottom trawling other than under CCAMLR is not managed for sustainability or for the protection of biodiversity. Thus efforts must

urgently be addressed to solving the larger problem of ensuring sustainable fisheries and protecting biodiversity. At the same time it is essential to identify the location of vulnerable ecosystems and to develop networks of protected areas both within and beyond national jurisdiction.

*In addition to ensuring overall sustainability of high seas bottom fisheries through an ecosystem-based management approach that eliminates destructive fishing practices and protects biodiversity, efforts should be made to encourage further use and development of conservation and management measures providing for the use of areas where fishing activities are strictly managed or excluded – to protect biodiversity and/or maintain ecosystem integrity.* R*egional agreements and arrangements should provide for establishing and enforcing closed or managed areas for these purposes. The technical guidelines on marine protected areas in fisheries management contemplated in COFI/2005/8 provide a good start, but FSA Parties may wish to consider developing a technical annex to the agreement.*

## HIGH SEAS BOTTOM TRAWLING IMPACTS ON COASTAL STATE CONTINENTAL MARGINS BEYOND 200 NAUTICAL MILES

Where high seas bottom trawling takes place in areas adjacent to exclusive economic zones (EEZs), it may have adverse consequences on fisheries and biodiversity within national jurisdiction.

Bottom trawling that takes place beyond the 200 n.m. EEZ (or beyond 12 n.m. territorial seas where EEZs or similar zones have not been established as in the Mediterranean) is high seas bottom trawling. At least 33 coastal States[48] have been identified as possibly having a continental margin that extends beyond 200 n.m (the legal continental shelf, defined in UNCLOS, art. 76). In these extended margin areas, if the stocks fished are sedentary species such as coral, scallops, or crab, the coastal State has exclusive rights to manage the fishery: no one may explore or exploit these resources without the express consent of the coastal State (UNCLOS, art. 77(d)). However, many States are not in a position today to assert and enforce these exclusive rights over continental shelf sedentary resources.

Where high seas bottom trawling targets non-sedentary species such as orange roughy in the extended margin area, it may impact the coastal State's sedentary species through physical destruction and bycatch (e.g., corals and sponges)-- but the rights of the coastal State are less clear. Moreover, until the outer limit of these wide margin areas is determined, it may be difficult for the coastal State to restrict foreign vessels engaged in bottom trawling. With a deadline of 2009 for final determination of these outer boundaries, it may be some time before many States can manage and protect the biodiversity of their wide margin areas.[49]

Coastal States may wish to establish protective measures directly or in consultation with an RFMO having competence over the relevant fishery(ies). Regarding disputed areas of the continental margin beyond 200 n.m., States parties to the dispute could consider joint action to protect the sedentary species of these areas from high seas bottom trawl fishing.

*Guidance should be developed for coastal States regarding the actions they can take to avoid damage to sedentary species and their habitat by foreign vessels engaged in high seas bottom trawling in these extended margin areas, including guidance on consultations with any RFMO having competence over these fisheries. Such guidance could also inform the development of national management*

*frameworks for marine and coastal biodiversity on the continental margin as encouraged in the decisions of CBD/COP7, including the establishment of areas closed to high seas bottom trawling. The technical guidelines contemplated in COFI/2005/8 on marine protected areas in fisheries management could play a role.*

## CRITICAL GAPS IN DEEP OCEAN RESEARCH AND ASSESSMENT

The significant problems of knowledge gaps applicable to deep sea fisheries are discussed in COFI/2005/6 and amplified in the Report on Deep Seas 2003[50] and in the accompanying CD Rom of the PowerPoint Presentations distributed by the organizers of the conference.

What is clear is that fisheries biologists and managers know too little to develop plans for a sustainable harvest. Further research is needed. Physiological attributes such as longevity, slow metabolism, low fecundity and delayed reproductivity makes many deep sea species highly vulnerable to overfishing—much more so than most shallow water fish species –and with potentially little resilience to overexploitation. There are significant gaps in current knowledge that undermine even the most cautious management—for example, information on the impact of fishing on the next generation of orange roughy will not be known for at least 20-30 years. Moreover, scientists are only now realizing that climate and oceanographic factors influence both recruitment and the productivity of habitat, but do not understand how[51].

Essential research on the ecology and biogeography of benthic species, notably in seamount and cold water coral and sponge communities, is still lacking This is critical to protect this biodiversity from the effects of high seas bottom trawl fishing and to develop precautionary, ecosystem-based management measures, including the identification of areas closed to fishing and areas where fisheries are to be strictly managed. Further work is also necessary to identify and map deep sea ecotypes/bioregions and the rare or fragile ecosystems subject to protection under UNCLOS, art. 194(5). This would contribute to the development of a global biogeographic framework that links protected areas with the sustainable use of living resources and the conservation of biological diversity and provides ecological coherence.

Research is also required to understand the effects on pelagic high seas fisheries (closer to the surface) that may result from changes in deep sea biodiversity due to bottom trawling and vice versa.

A basic duty of States and competent international organizations is to make available information on proposed major marine scientific research programs and the knowledge that results from them. They should actively promote the transfer of knowledge to developing States and strengthen their research capabilities. In the seabed beyond national jurisdiction, marine scientific research is to be carried out for the benefit of mankind as a whole, and the International Seabed Authority (ISA) has a special role in undertaking and promoting this research and coordinating and disseminating results (UNCLOS, arts. 244, 143). The FSA, building on UNCLOS provisions, promotes international cooperation and capacity building in fisheries-related research and widespread publication and dissemination of results regarding areas beyond national jurisdiction (UNCLOS, art. 119(2); FSA, art. 14(3)).

*Efforts are needed on three fronts*:

i) to draw together existing knowledge of deep sea biodiversity and productivity;
ii) to ensure widespread availability and dissemination of research findings; and
iii) to strengthen the involvement and capacity of developing States so that all States benefit from this knowledge.

*The FAO Strategy for Improving Information on Status and Trends of Capture Fisheries addresses these points. Governments, FAO, RFMOs and other international bodies should move ahead with exploring how to advance this initiative, including its application to deep sea fisheries, in order to realize the objective of the Strategy as a "framework for the improvement of knowledge and understanding of fishery status and trends as a basis for fisheries policy-making and management for the conservation and sustainable use of fishery resources within ecosystems" (para. 12).*

*In addition, FAO should agree to address the information deficiencies identified in COIF/2005/6, including those identified above.*

## *CONCLUSION*

For rapid progress to be made in addressing the impact of destructive fishing practices including bottom trawling that has adverse impacts on seamounts, cold water corals and other vulnerable ecosystems beyond national jurisdiction, critical gaps and deficiencies in governance and management of deepwater fisheries beyond national jurisdiction must be addressed. IUCN recommendations to COFI are detailed above.

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[1] Interim Summary, DEEP SEA 2003 Conference on the Management and Governance of Deep Sea Fisheries, held in Queenstown, New Zealand, organized by the Ministry of Fisheries, New Zealand and the Department of Agriculture, Fisheries and Forestry of Australia, with the technical cooperation of the FAO Fisheries Department. (www.deep sea.govt.nz). The full report will be available soon.
[2] Butler A.J., Koslow, J.A., Snelgrove, P.R.V., Juniper, S.K., (2001). *A Review of the Biodiversity of the Deep Sea*. Environment Australia, Canberra. Commonwealth of Australia, 2001.
[3] Where the continental margin (submerged prolongation of the land mass of the coastal state) extends beyond 200 n.m. from the baseline of the territorial sea, this forms part of the coastal state's *legal* continental shelf, whose outer limits are defined in art. 76 of the UN Convention on the Law of the Sea. The coastal state exercises sovereign rights for the purpose of exploiting the natural resources of its legal continental shelf. For living resources, these consist of organisms belonging to sedentary species, as defined in art. 77.4, including corals, crab, mollusks and sponges.
[4] For a comprehensive overview, see Stone, G., Madin, L., Stocks, K., Hovermale, G., Hoagland, P., Schumacher, M., Steve-Sotka, C. and Tausig, H. (2004). *Seamount Biodiversity, Exploitation and Conservation* in Defying Oceans End: An Agenda for Action (eds. Glover, L.K., and Earle, S.A.) Island Press. See also Roberts, CM. (2002) Deep impact: the rising toll of fishing in the deep sea. *Trends in Science and Ecology;* Koslow, J.A., Gowlett-Holmes, K., Lowry, J.K., O'Hara, T., Poore, G.C.B. and Williams, A. (2001). Seamount benthic macrofauna off southern Tasmania: community structure and impacts of trawling *Mar Ecol Prog Ser* 213:111-125; Richer de Forges, B, Koslow, J.A., Poore, G.C.B. (2000), Diversity and endemism of the benthic seamount macrofauna in the Southwestern Pacific. *Nature* 405:944-947.
[5] Many additional features of several hundred meters or more are believed to exist along continental margins and oceanic ridge systems. These are sometimes referred to as seamounts or variously as hills, knolls, and mounds. While the location of the 1000-meter-plus seamounts is generally known, much less is known about the location of these smaller features, though they are thought to contain similarly high levels of endemism.
[6] Rogers, A.D. (1994). The biology of seamounts. *Advances in Marine Biology* 30: 305-354.
[7] Stone et al. (2004) note 4 above.
[8] Richer de Forges, B. et al. (2000), note 4 above.
[9] Freiwald, A., Fossa, J.H., Grehan, A., Koslow, A.J., Robets, J.M. 2004. Cold –water Coral Reefs, UNEP-WCMC, Cambridge, UK (available at www.unep-wcmc.org/resources/publications/UNEP_WCMC_bio_series/22.htm); See also Gubbay, S (2003)."Protecting the Natural Resources of the High Seas: Scientific Background Paper" in *Towards a Strategy for High Seas Marine Protected Areas: Proceedings of the IUCN, WCPA and WWF Experts Workshop on High Seas Marine Protected Areas,* 15-17 January 2003, Malaga, Spain, (Annex 3) (Gjerde, KM and C Breide, editors) available at http://www.iucn.org/themes/marine/pdf/GjerdeBreideHSMPA.pdf
[10] Freiwald et al. (2004) note 9 above (for a full listing of all 41 countries, see p. 21)
[11] Freiwald et al. (2004) note 9 above, at p. 26.
[12] Freiwald et al. (2004) note 9 above, at p. 26.
[13] Stone et al. (2004) note 4 above.
[14] Koslow, J.A., Boerhlert, G.W., Gordon, J.S.M., Haedrich, R.L., Lorance , P. and Parin, N. (2000). Continental slope and Deep Sea fisheries, implications for a fragile ecosystem, *ICES Journal of Marine Science*, 57: 548-557
[15] Roberts, C.M. (2002) note 4 above; Chuenpagdee, R., Morgan, L.E., Maxwell, S.M., Norse, E.A., and Pauly, D. (2003) Shifting gears: assessing collateral impacts of fishing methods in US waters, *Frontiers in Ecology* 1(10: 517-524)
[16] Koslow, et al. (2000) note 14 above; Chuenpagdee et al. (2003) note 15 above; Roberts, C.M., Gell, F. R., and Hawkins, J.P. (2003) *Protecting national important marine areas in the Irish Sea Pilot Project Region*, Report prepared for the UK Joint Nature Conservation Commission, and the cites therein.
[17] Koslow, et al. (2001), note 4 above.
[18] Stone et al. (2004) note 4 above.
[19] Gianni, M. (2004). *High Seas Bottom Fisheries an their Impacts on the Biodiversity of Vulnerable Deep Sea Ecosystem: Options for International Action*, IUCN, Gland, Switzerland (available at: http://www.iucn.org/themes/marine/pdf/Gianni_HS-BottomTrawling_FullVersion.pdf)
[20] Anderson O.F., Clark, M.R. (2003). Analysis of the bycatch in the fishery for orange roughy, Hoplostethus atlanticus, on the South Tasman Rise. *Marine and Freshwater Research*, 54 643-652. Table 5.CSIRO Publishing.
[21] Butler, A., Furlani, D., Hayes, D. (2003). Effects of Demersal Fishing on the High Seas. CSIRO Marine Research, updated 13 Nov. 2003; alan.butler@csiro.au; Roberts, S. and Hirshfield, M. Deep Sea corals: out of sight, but no longer out of mind. *Frontiers in Ecology* 2004; 2(3):123-130.
[22]Koslow, et al. (2000) note 14 above. Lack, M, Short, K., and Willock, A. (2003) *Managing Risk and uncertainly in Deep Sea fisheries: lessons from Orange Roughy*. TRAFFIC Oceania and the WWF Endangered Seas Programme (available at: www.panda.org/downloads/marine/OrangeRO.pdf.)

[23] Koslow, et al. (2000) note 14 above.
[24] Rogers, A. (2004). *The Biology, Ecology and Vulnerability of Deep-Water Coral Reefs (IUCN, Gland*) available at: <http://www.iucn.org/themes/marine/pdf/AlexRogers-CBDCOP7-DeepWaterCorals-Complete.pdf>
[25] IUCN-Shark Specialist Group. (2003). Preliminary report of *"Conservation and Management of Deep Sea Chondrichthyan Fishes" Pre-Conference Meeting* held in conjunction with DEEP SEA 2003, University of Otago, Dunedin, New Zealand. 27 - 29 November 2003.
[26] Gubbay, S. (2002), The Offshore Directory. *Review of a selection of habitats, communities and species of the north-east Atlantic*. A report for WWF by Susan Gubbay with contributions from Maria Baker, Brian Bett and Gerd Konnecker. October 2002.
[27] Rogers (1994) note 6 above.
[28] Rogers (1994) note 6 above
[29] Rogers (1994) note 6 above
[30] Large, P.A., Hammer, C., Bergstad, O.A., Gordon, J.D.M., Lorance, P. (2003).Deepwater Fisheries of the Northwest Atlantic: II Assessment and Management Approaches *J. Northw. Atl. Fish Science*, Vol. 31: 151-163
[31] Cavanagh, R.D., Kyne, P.M., Fowler, S.L., Musick, J.A., and Bennett, M.B. (editors, 2003) Conservation Status of Australian Chondrichthyans: Report of the IUCN Shark Specialist Group Australia and Oceania Regional Red List Workshop. The University of Queensland, School of Biomedical Sciences, Brisbane, Australia. x + 170pp.
[32] Gianni (2004) note 19 above
[33] Lack et al. (2003) note 22 above.
[34] UN FAO, Report of the Second Ad Hoc Meeting on Management of Deepwater Fisheries Resources of the Southern Indian Ocean - Fremantle, Western Australia, 20-22 May 2002, FAO Fisheries Report No. 677, Rome, 2002. www.fao.org/DOCREP/005/Y3992E/y3992e00.htm#Contents; Fishing News International 41/7, August 2002, p17.
[35] Gianni (2004), note 19 above
[36] Gianni (2004), note 19 above.
[37] UN General Assembly Resolution on Oceans and the Law of the Sea, 10 November 2004, A/59/L.22, Resolution 59/24, at http://www.un.org/Depts/los/general_assembly/general_assembly_resolutions.htm, ("Oceans Resolution"), Paragraph 70.
[38] Oceans Resolution, paragraphs 73-76.
[39] UN General Assembly Resolution on Sustainable Fisheries, 10 November 2004, A/59/L.23, Resolution 59/25, at http://www.un.org/Depts/los/general_assembly/general_assembly_resolutions.htm, "Sustainable Fisheries Resolution), paragraph 66.
[40] Gianni (2004) note 19 above; NEAFC press release; GFCM press release.
[41] Of the current catch in high seas bottom fisheries, a significant portion is taken from straddling stocks, and most of the States that have been engaged in these fisheries during the last several years are FSA parties, as are many of the coastal States likely to be impacted by unregulated Deep Sea fishing on the adjacent high seas. Gianni (2004) note 30 above.
[42] The definition includes also fishing in an area subject to an RFMO conducted by a non-party State in a manner inconsistent with the RFMO's measures (IPOA IUU Fishing art. 3).
[43] Gianni (2004), note 19 above
[44] Molenaar, E.J. (2004) Unregulated Deep Sea Fisheries: A Need for a Multi-Level Approach, *in* Unfinished Business: Deep Sea Fisheries and the Conservation of Marine Biodiversity Beyond National Jurisdiction, special issue of *the International Journal of Marine and Coastal Law* 19:3, pp.224-249), 229 (eds. Gjerde, K. and Freestone, D.)
[45] ICES Advisory Committee on Fisheries Management, 2004
[46] Gianni (2004), note 19 above.
[47] Butterworth, D. and Brandão, A (2004). "Experiences In Southern Africa In The Management Of Deep Sea Fisheries", DEEP SEAS 2003, PowerPoint presentations CD Rom, Theme 3.2; Lack et al. (2004) note 22 above.
[48] Angola, Argentina, Australia, Brazil, Canada, Denmark, Ecuador, Fiji, France, Guinea, Guyana, Iceland, India, Indonesia, Ireland, Japan, Madagascar, Mauritius, Mexico, Micronesia (Federated States of), Myanmar, Namibia, New Zealand, Norway, Portugal, Russian Federation, Seychelles, South Africa, Spain, Suriname, United Kingdom, United States, and Uruguay. See UN Document SPLOS/64, 1 May 2001, at note 2.
[49] The process for delimitation of the outer boundary area is set forth in UNCLOS, art. 76. It entails submitting data and information to the Commission on the Limits of the Continental Shelf (CLCS) established by the Convention, Annex II. As of April 2004, only the Russian Federation has done so.
[50] Interim Summary of DEEP SEAS 2003, note 1 above.
[51] Interim Summary of DEEP SEAS 2003, note 1 above.