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OPTIONS FOR PREVENTING AND MITIGATING THE IMPACT OF SOME ACTIVITIES ON SELECTED SEABED HABITATS

Background document to the note by the Executive Secretary on options for preventing and mitigating the impact of some activities to selected seabed habitats, and ecological criteria and biogeographic classification systems of marine areas in need of protection (UNEP/CBD/SBSTTA/13/4)

Note by the Executive Secretary

I. BACKGROUND, SCOPE, AND PURPOSE

1. Three decades ago, little was known of the marine areas beyond the limits of national jurisdiction that could be useful for their management and conservation. Marine areas beyond the limits of national jurisdiction were too remote and difficult to reach, largely out of sight and obscure until the late 1970s, when, with the aid of advanced acoustics, remotely operated vehicles (ROVs), human occupied submersibles, and other advanced underwater technologies, hydrothermal vents, and later cold seeps and other deep seabed habitats of ecological and economic importance were discovered (UNOLS 2000; Van Dover 2000; ONR n.d.).

2. It has been commonly observed that the need for the conservation of natural resources is often not recognized until the threat of overexploitation becomes apparent. Conservation does not become an issue until the level of threat to a species either puts it at risk of severe depletion or endangers its survival (Birnie and Boyle 2002). For example, in the case of fisheries, the expansion of fisheries into offshore and deeper waters and the shift by distant water fishing nations of their fisheries to the areas beyond the limits of national jurisdiction have generally occurred for one of two reasons, either: (i) as a consequence of coastal States gaining sovereign rights for the exploration and exploitation of living and nonliving resources within their exclusive economic zones upon the adoption of the 1982 United Nations Convention on the Law of the Sea (UNCLOS); 1/ or (ii) as a result of the decline of shallow coastal water resources, increasing fish demand, and new technology (Breide and Saunders 2005; Morato et al. 2006b). The discovery of the potential value of genetic resources associated with deep seabed habitats to various sectors, including the health and food sectors, has intensified deep seabed research and bioprospecting, albeit restricted to those actors with the requisite technological capacity and the financial resources to access these remote areas (Arico and Salpin 2005). There are clear indications that deep-water fish stocks

* UNEP/CBD/SBSTTA/13/1.

1/ As defined in Article 56 of the 1982 United Nations Convention on the Law of the Sea (1982 UNCLOS).

/…

may be at serious risk of depletion (Morato et al. 2006a; Morato et al. 2006b), as well as evidence of destruction of seabed habitat, particularly from destructive fishing practices and, to some extent, research activities and bioprospecting (Gianni 2004; Arico and Salpin 2005; Stone 2006). Other emerging problems affecting deep seabed habitats include marine debris; ship-source pollution, including transfer of alien or invasive species, illegal dumping and the legacy of historical dumping; seabed minerals development; and noise pollution (Kimball 2006).

3. The United Nations Convention on the Law of the Sea (UNCLOS) provides the legal framework within which all activities in the oceans and seas must be carried out. UNCLOS, its Implementing Agreements (namely the Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, 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), and the Convention on Biological Diversity (CBD) are the major legal instruments relevant to the prevention and mitigation of the impacts of some activities on selected seabed habitats, along with several other international conventions, regional seas agreements, and regional fishery management conventions (CBD 2005d; Henriksen et al. 2006). In addition, a number of non-binding global instruments which provide a policy framework for the use of management tools are also relevant.2/

4. Article 2 of the Convention on Biological Diversity (CBD), which entered into force in 1993, defines biodiversity, while Article 1 defines its objectives, including the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. In areas beyond the limits of national jurisdiction, the Convention applies only to processes and activities carried out under the jurisdiction or control of its parties.

5. The Conference of the Parties (COP) to the Convention on Biological Diversity, at its eighth meeting in 2006 requested the Executive Secretary, in collaboration with the United Nations Division for Ocean Affairs and the Law of the Sea (DOALOS) and other relevant international organizations, to further analyze and explore options for preventing and mitigating the impacts of some activities on selected seabed habitats and to report the findings to future meetings of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) (paragraph 7 of decision VIII/21 on Marine and coastal biological diversity: conservation and sustainable use of deep seabed genetic resources beyond the limits of national jurisdiction).The Conference of the Parties noted that deep seabed ecosystems beyond the limits of national jurisdiction contain genetic resources of great interest for their biodiversity value and for scientific research, as well as for present and future sustainable development and commercial applications (decision VIII/21). It recognized that given the vulnerability and general lack of scientific knowledge of deep seabed biodiversity, there is an urgent need to enhance scientific research and cooperation and to provide for the conservation and sustainable use of these genetic resources in the context of the precautionary approach.

6. The United Nations General Assembly (UNGA) is also addressing issues relating to marine biodiversity beyond areas of national jurisdiction. In particular, in paragraph 73 of resolution 59/24, of 17 November 2004, on Oceans and the Law of the Sea, the General Assembly called for the establishment of an Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction. 3/ The UNGA in resolution 61/222 of 20 December, 2006, on Oceans and the Law of the Sea, requested the Secretary-General to convene a second meeting of the United Nations Ad Hoc Open-ended Working Group in 2008. The UNGA, in the same resolution, also decided that the eighth meeting of the United

2/ To view detailed information on the legal regime governing some activities in areas beyond national jurisdiction please see the UN Secretary-General's reports on the website of the United Nations Division for Ocean Affairs and the Law of the Sea, e.g., A/59/62, A/59/62/Add.1, A/60/63/Add.1, A/62/66: http://www.un.org/Depts/los/general_assembly/general_assembly_reports.htm.

3/ The report of the meeting is contained in United Nations document A/61/65.

Nations Open-Ended Informal Consultative Process on the Law of the Sea (the Consultative Process) would focus its discussions on "marine genetic resources".

7. This note synthesizes existing information as it relates to options for preventing and mitigating the impacts of some activities on selected seabed habitats, particularly hydrothermal vent, cold seep, seamount, cold-water coral and sponge reef ecosystems, each of which have been shown to host high levels of endemism and diversity, and are possible sources of new genetic resources (CBD 2005a; CBD 2006e). First, the report provides a summary of the biodiversity value and importance of these seabed habitats. Second, it presents an assessment of the state of knowledge of the existing and potential threats to these seabed habitats. Third, it reviews previous analyses of options for addressing the identified threats to seabed habitats found in binding and non-binding international instruments. Fourth, it further analyzes and explores options for preventing and mitigating threats to deep seabed habitats in areas beyond the limits of national jurisdiction, including: (i) the use of codes of conduct, guidelines and principles; (ii) management of threats through permits and environmental impact assessments; (iii) area-based management of uses, including through the establishment of marine protected areas; and (iv) ecosystem-based and integrated management approaches (CBD 2005a).

8. For this note, options for prevention are taken to mean "action[s] taken to reduce known risks" (European Environment Agency 1995-2007), while options for mitigation mean the actions taken as "restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means" (Canadian Environmental Assessment Agency 2003). "Some activities" in this document refers to human activities, which have existing and/or potential adverse impacts to seabed habitats.

9. This note relied mainly on the synthesis of available literature and on lessons learned from experience as reported in various sources for the analysis of the potential applicability of certain management and conservation techniques. The information sources for this report include journal articles; books; proceedings of conferences, workshops, and other meetings; newspaper articles; websites of research programs; full texts of international environmental agreements; and reports and other documents developed in the context of the Convention on Biological Diversity and the United Nations General Assembly, including the Consultative Process and the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction. The note takes into consideration comments submitted by Parties, other Governments and organizations as well as expert groups, including the Census of Marine Life programme CenSeam (a global census of marine life on seamounts) Data Analysis Working Group and the participants to the Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection (held from 2 to 4 October 2007, in Azores, Portugal), from 26 October to 23 November 2007, during which time the note was posted on the Convention website for peer review (notification 2007-130). The study for this note was conducted with the financial support from the European Commission.

II. BIODIVERSITY VALUE AND IMPORTANCE OF SELECTED SEABED HABITATS

10. This section focuses on hydrothermal vent, cold seep, seamount, cold water coral and sponge reef ecosystems, which were noted by the Conference of the Parties, at its eighth meeting (paragraph 1, decision VIII/21), as important for their high levels of endemism and diversity, and as potential sources of new genetic resources with potential commercial applications (CBD 2005a; CBD 2006e).

A. Hydrothermal vents

11. Hydrothermal vents are fissures and crevices on the earth's surface typically found along mid-ocean ridges, at an average depth of 2,100 m (CBD 2005a). These cracks and crevices on the ocean floor are created where the earth's tectonic plates are gradually moving apart, while magma rises to fill the gap, sometimes leading to submarine volcanic eruptions. This shallow magma heats the surrounding seawater up to 400ºC, which seeps through the cracks and flows back, laden with mineral salts, out into

the ocean through openings in the seafloor (CBD 2005a; NOAA Vents Programme n.d.). Vents are also characterized by high acidity, extreme salinity and high concentrations of metals and chemical compounds such as sulfur, hydrogen and methane on which microorganisms at the lower trophic levels of the hydrothermal vents' food chains depend. Hydrothermal vents are found only in areas where there is volcanic activity and magma is close enough to the surface to heat the fluids, including active spreading ridges, subduction zones, fracture zones, and seamounts (CBD 2005a). There are 212 known (i.e., ground-truthed) and suspected (i.e., plumes observed, vents not yet ground-truthed) hydrothermal vents currently listed in the InterRidge Hydrothermal Vent Database (InterRidge n.d.).

12. Photosynthetic primary production is replaced by chemoautotrophic primary production in hydrothermal vents. The primary producers in this system are the wide variety of bacteria and archaea that utilize sulfur, hydrogen, methane, and other compounds released by the reactions between seawater and magma beneath the mid-ocean ridge system and other centres of seafloor volcanism. Among these microbes are the *thermophilic* and *hyperthermophilic archaea*, some of which have optimal growth rates at temperatures exceeding 100°C. The archaea have specialized enzymes that allow them to cope with and thrive in extreme levels of temperature and pressure. These enzymes are of great interest to the biotechnology community for potential industrial applications. Deep-sea hydrothermal vent organisms are of particular interest because of their adaptation to a high pressure/high temperature environment (NOAA Vents Programme n.d.).

13. A review of macrofauna from vents and immediate vicinity by D. Desbruyères et al. (2006) indicated 471 recorded species of which 91% are endemic (molluscs 29%, crustaceans 33%, polychaetes 17%) (Desbruyères et al. 2006).

14. Biogeography is as important as biodiversity with respect to management and conservation. Vent faunas differ in different ocean basins (Van Dover et al. 2002), sometimes at a fairly fine scale (for example, back-arc basins in the Southwest Pacific), which is a key point for management. In addition, it is important to emphasize that there exists a "rare diversity" among the invertebrate faunas as well as among the microbial faunas: many species (the majority) at any given site are very rare in samples, as has been repeatedly shown for example in mussel-bed studies (e.g., Van Dover 2002; 2002; 2003). These rare species may have been or may become more dominant during venting conditions that have not yet been observed, either now or in the geological record of vents (C. Van Dover, October 29, 2007).

15. A recent study indicated that microorganisms account for the majority of genetic and metabolic variations in the oceans and that the genetic diversity, community composition, relative abundance, and distribution of microorganisms in the sea remain under-sampled and essentially unexplored (Sogin et al. 2006). The study also showed that bacterial communities of deep-water masses of the North Atlantic and diffuse-flow hydrothermal vents are one to two orders of magnitude more complex than previously reported for any microbial environment. A relatively small number of different populations dominate all samples, but thousands of low-abundance populations account for most of the observed phylogenetic diversity. This "rare biosphere" is deemed ancient and may represent a virtually infinite source of genomic innovation. Members of the rare biosphere are highly divergent from each other and, at different times in the earth's history, may have had a profound impact on shaping planetary processes (Sogin et al. 2006). While biogeographic patterns are evident in the invertebrate fauna, biogeographic differentiation among microbial populations remains to be understood, which has implications for management (C. Van Dover, October 29, 2007).

16. Hydrothermal vents are also important ecologically for their: (i) contribution to the cooling of the planet as a whole, to its thermal balance, and to the chemical balance of the oceans and the atmosphere; (ii) putative role in the origin of life; (iii) contribution to ascending organic matters that support upper zooplankton communities; and (iv) participation in the global carbon cycle since the organic substance originating from hydrothermal vents supports the transfer of energy through resident species and perhaps through upper water column species (Van Dover 2000; Arico and Salpin 2005; Leary 2007).

B. Cold seeps

17. Cold seep ecosystems occur on active and passive continental margins, where methane-rich fluids, or higher hydrocarbons emerge from seafloor sediments without an appreciable temperature rise when fluids reach the seafloor (Sibuet and Olu-Le Roy 1998; 2002; Levin 2005). The first cold-seep ecosystem was found just 20 years ago on the Florida Escarpment in the Gulf of Mexico. Initial exploration of this seep and others in the Gulf of Mexico, off Oregon and in Japanese trenches revealed communities dominated by symbiont-bearing tubeworms, mussels, and clams, often belonging to genera found earlier at hydrothermal vents. Since that discovery, large numbers of cold seeps, including fossil seeps, have been identified in a broad range of tectonic settings, on both passive and active continental margins (Levin 2005). With new sites reported every year, it is assumed that only a small fraction of existing seafloor seeps have been discovered so far. Seep communities are known to exist from depths of less than 15 m to greater than 7,400 m. Active seeps have been reported from all oceans of the world except the Arctic (Vogt et al. 1997; Levin 2005). A new habitat for chemotrophic ecosystems has been found beneath the former extent of the Larsen Ice Shelf in Antarctica, the first report of such ecosystems in the Antarctic (Domack et al. 2005).

18. Chemosynthesis-based communities depend on autochthonous and local chemical energy to produce organic carbon in large quantities through microbial chemosynthesis. The high organic carbon production leads to the large size of the fauna and the high biomass of the communities supported by cold seeps (Sibuet and Olu-Le Roy 2002). The seepage of reduced fluids in cold seeps results in a wide range of geological and sedimentary forms, with large amounts of methane expelled as dissolved or free gas, or gas bubbles after dissociation of gas hydrates being the most conspicuous manifestation. Other geological structures include: microbial mats, pockmarks, carbonate platforms and mounds, reef-like communities, mud volcanoes and ridges, gas hydrates, and hypogenic caves (Levin 2005).

19. Megafaunal biomass at seeps, which far exceeds that of surrounding non-seep sediments, is dominated by bivalves and *vestimentiferan tubeworms*, with *pogonophorans*, *cladorhizid* sponges, gastropods, and shrimp also sometimes abundant. In contrast, seep sediments at shelf and upper slope depths have infaunal densities that often differ little from those in ambient sediments. At greater depths, seep infauna exhibit enhanced densities, modified composition, and reduced diversity relative to surrounding sediments. *Dorvilleid*, *hesionid* and *ampharetid polychaetes*, *nematodes*, and *calcareous foraminiferans* are dominant. Spatial heterogeneity of microbes and higher organisms is extensive at seeps. Specialized infaunal communities are associated with different seep habitats (microbial mats, clam beds, mussel beds, and tube worm aggregations) and with different vertical zones in the sediment (Levin 2005).

20. *Vestimentiferan tubeworms* are entirely reliant on internal sulphide-oxidizing chemoautotrophic bacterial symbionts for their nutrition. The most common *vestimentiferan tubeworm* of the Upper Louisiana Slope of the Gulf of Mexico is *Lamellibrachia luymesi*, which, together with other species of tubeworms, forms aggregations of hundreds to thousands of individuals and harbours a diverse community of associated species. In a study of 40 tubeworm aggregation and mussel bed samples containing at least 171 macrofaunal species collected at seeps from 520 to 3300 m depth, it was found that the Upper Louisiana Slope communities appear to advance through a succession of stages. The youngest aggregations contain high biomass communities dominated by endemic species, with biomass decreasing over time as the relative abundance of non-endemic fauna in upper trophic levels increases. This process is mainly driven by the abundance of hydrogen sulphide in the epibenthic layer. Models support the hypothesis that *L. luymesi* alters its environment by releasing the sulphate generated by its internal symbionts into deeper sediment layers. This alters the distribution of sulphide leading to declines in sulphide concentrations among the tubeworm tubes. The combination of these lines of evidence supports the assertion that *L. luymesi* is a significant ecosystem engineer at hydrocarbon seeps in the Gulf of Mexico (Cordes 2004).

21. Where studies have been undertaken, growth rates of cold-seep *Vestimentiferan tubeworms* were reportedly very slow (Fisher et al. 1997). This contrasts with the extremely rapid growth rates of tubeworms at hydrothermal vents, which suggests the need for different management plans and approaches at vents versus seeps (C.L. Van Dover, October 29, 2007).

22. A comparison of sediment samples taken above outcropping methane hydrates at Hydrate Ridge (Cascadia margin off Oregon) and in massive microbial mats enclosing carbonate reefs (Crimea Area, Black Sea) showed, through DNA analysis, the ubiquitous presence of *methanotrophic archaea* in almost all methane environments so far investigated, independent of the in situ temperature, depth, pressure, and methane and sulphate concentrations in the environment (Knittel et al. 2005). In other areas, some animals have been found to tolerate relatively high sulphide levels despite the toxicity of the cold seep environment. The mechanisms which enable marine organisms to survive high sulphide levels include: 1) the removal of sulphide at the body wall through a layer of sulphide-oxidizing bacteria, and/or enzymatic sulphide oxidation; 2) sulphide-insensitive haemoglobin; 3) reversible sulphide binding to blood components; 4) mitochondrial sulphide oxidation to less toxic compounds through ATP synthesis; and 5) reliance on anaerobic respiration at high sulphide levels (Levin 2005).

23. Fossil seeps, along with fossil hydrothermal vents, are important in confirming that chemosynthesis-based paleoenvironments have been diverse and variable throughout Earth's history in terms of both geologic settings and taxonomic compositions. The taxonomy and systematics of fossils in chemosynthesis-based settings provide evidence for evolutionary hypotheses on the origins of the modern seep-vent fauna. Paleobiogeographic data also help explain current distribution patterns of vent-seep taxa worldwide, driven largely by plate tectonics, sea-level change, and by the location, burial, and exhumation history of sedimentary organic matter through time, including ocean anoxia episodes. Ancient vents and seeps reveal the evolution of organisms living in extreme environments (Campbell 2006).

C. Seamounts

24. Seamounts are submarine elevations with a variety of shapes, although they are generally conical with a circular, elliptical, or more elongate base, and have a limited extent across the summit (Rogers 1994). There have been various efforts at estimating the number of seamounts worldwide using a range of methods. Based on analyses of updated satellite and multibeam data, it is predicted that 100,000 or more large seamounts may exist worldwide; of these, the locations of ~14,000 have been predicted, with just over half of them located in areas beyond the limits of national jurisdiction (Alder and Wood 2004; Kitchingman et al. 2007).

25. Seamounts may form biological hotspots with a distinct, abundant and diverse fauna, and sometimes contain many species new to science. The distribution of organisms on seamounts is strongly influenced by the depth the seamount rises to, and by the interaction between seamount topography and currents. Seamount communities are often dominated by sessile (attached) organisms that feed on suspended food particles, including corals, barnacles, bryozoans, *polychaete worms*, mollusks, sponges, sea squirts, and crinoids (Clark et al. 2006). The fauna of seamounts can be highly diverse and species may have a very limited distribution restricted to a single geographic region, a seamount chain, or even a single seamount location (Rogers 2004). However, estimates of the level of this restricted distribution ("endemism") are highly variable, and often reflect limited sampling. Overall seamount endemism appears to be about 20% (Stocks and Hart 2007). Seamount communities are often associated with biological habitats such as deep-water coral reefs, which present additional complexity to the seamount environment (Probert et al.1997; Rogers 2004; Rogers et al. 2007).

26. Seamounts can affect local oceanographic currents, and well known effects with potential significance to seamount biology are upwellings of nutrient-rich waters and the formation of eddies of water ("Taylor Columns"), which can keep animals trapped above the seamounts. Seamounts and the water column above them serve as important habitats, feeding grounds, and reproduction sites for many open-ocean and deep-sea species of fish, sharks, sea turtles, marine mammals, seabirds, and a great variety of benthic organisms (Rogers 2004; Pitcher et al. 2007).

27. Seamounts support a large and diverse fish fauna of up to 798 species (Morato and Clark 2007). Deep-water trawl fisheries over seamounts occur in areas beyond the limits of national jurisdiction for around 20 major species, including alfonsino (*Beryx splendens*), black cardinalfish (*Epigonus telescopus*), orange roughy (*Hoplostethus atlanticus*), armourhead and southern boarfish (*Pseudopentaceros spp.)*, redfishes (*Sebastes spp*.), macrourid rattails (*primarily roundnose grenadier Coryphaenoides rupestris*), oreos (including smooth *oreo Pseudocyttus maculatus*, black *oreo Allocyttus niger*), Patagonian toothfish (*Dissostichus eleginoides*), and in some areas Antarctic toothfish (*Dissostichus mawsoni*) (Clark et al. 2007). Pelagic fisheries also occur over seamounts, mainly for tunas (e.g., Holland and Grubbs 2007) and black scabbardfish (*Aphanopus carbo*). The total historical catch from seamounts has been estimated at over two million tonnes (Clark et al. 2007).

D. Cold-water coral and sponge reefs

28. The scale and abundance of cold-water corals have recently been shown to encompass individuals, isolated colonies, small patch reefs, large reefs, and giant carbonate mounds of up to 300 m high and several kilometres in diameter (Roberts et al. 2006). Cold-water coral reefs may be many thousands to millions of years old; and due to their age and slow growth rates, reefs contain high-resolution records of long-term climate change and may be important speciation centres 4/ in the deep sea.

29. Cold-water corals are generally restricted to oceanic waters and temperatures between 4ºC and 12ºC, which are commonly found in relatively shallow waters (~50 to 1,000 m) at high latitudes, and at great depths (up to 4,000 m) beneath warm water masses at low latitudes. Around 800 species of reef-building *scleractinians* (stony corals) are described in shallow waters, but fewer than 10 are known to build substantial deep-water reef frameworks, as shown in figure 1. This is an incomplete view of deep-water coral reef distribution, which remains skewed by the geographically clustered levels of research activity and the predominance of deep-water mapping initiatives by the developed world (Roberts et al. 2006).

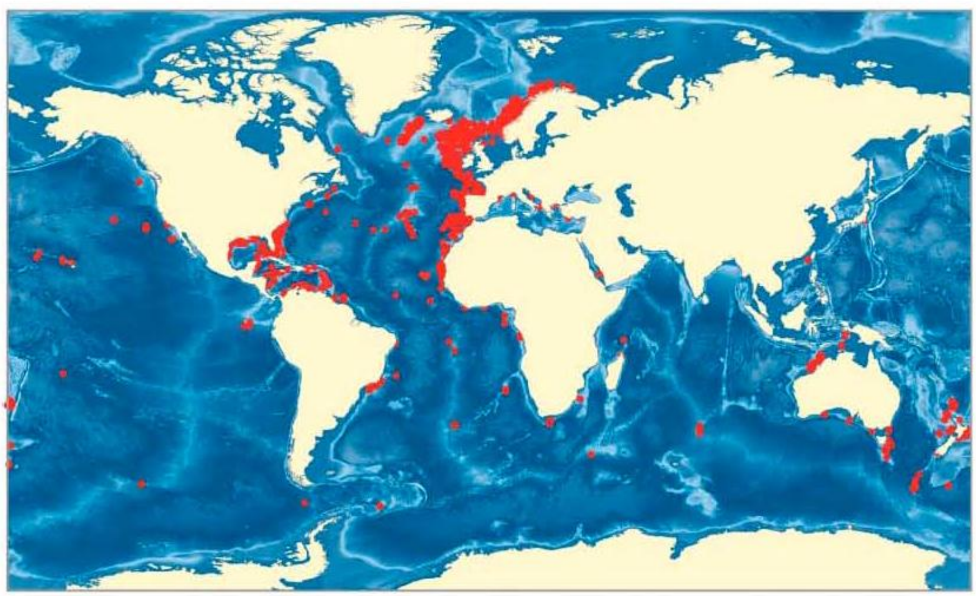

Figure 1. Current global distribution of reef framework–forming cold-water corals [modified from Freiwald et al. 2004]. Source: Roberts et al. (2006).5/

4/ Speciation centers "… are discrete geographic regions with high concentrations of [species] appearances or extinctions" (*Research Projects Carried Out with Neptune, What They told Us, and Recommendations for the Future.* Available: http://palaeo-electronica.org/1999_2/neptune/research.htm).

5/ Colour versions of this map are available electronically at www.cbd.int.

30. Massive tropical reef corals may live for several centuries, providing long-term proxy or substitute records of ocean climate. However, their use is restricted by their limited geographic distribution. Recent research in paleoclimatology has discovered the enormous potential of climate records in the skeletons of cold-water corals, since they are found in all oceans and at all depths from sea level to at least 4 km (Risk et al. 2005). For example, cold-water corals record several decades of information on ocean temperatures through growth bands (Risk et al. 2005; Sinclair et al. 2005). Long-term climate proxies provide information that contributes to the understanding of global climate change and can be used to accurately predict climate change far into the future.

31. The biodiversity in cold-water corals, because of habitat complexity, is comparable with that found in tropical coral reefs. For example, over 1,300 species have been reported living in *Lophelia pertusa* reefs in the Northeast Atlantic (Freiwald et al. 2004). However, quantitative regional comparisons are needed to confirm species richness. Further studies are also needed on the functional relationships between species on cold-water coral reefs and the reef's importance as a fish habitat (Roberts et al. 2006). Cold-water coral reefs are frequently reported on seamounts, which produce localized circulation patterns that trap larvae leading to limited species dispersal, local adaptation, and enhanced rates of speciation. By virtue of their high species diversity, propensity to localized circulation patterns, and longevity, cold-water corals may also be major speciation centres (Roberts et al. 2006).

32. Cold-water coral reefs provide habitat, feeding grounds, recruitment, and nursery areas for deep-water organisms, including commercial fish species (Costello et al. 2005; UNEP n.d.). The level of importance of deep-water corals in the demography of fish populations and communities is, however, still uncertain (Auster 2005; UNEP n.d.).

33. Sponge fauna are commonly associated with coral reefs, including deep-sea coral reefs (Longo et al. 2005). Sponges of the class Hexactinellida (*Phyllum Porifera*) also form reefs. They produce a skeleton of nearly pure glass (SiO^2), which, as in the case of glass sponges of North America, consists of a rigid, three-dimensional framework that remains long after the sponge has died, forming a substrate for future generations of sponges. Glass sponges typically live in deep oceans (500 to 3,000 m) worldwide. At least seven reefs of hexactinellids have recently been discovered at 165 to 240 m in Hecate Strait and the Strait of Georgia, British Columbia. Although extensive reefs of glass sponges were common 200 million years ago, today the Canadian sponge reefs are the only ones known to exist. Because of their immense size the sponge reefs are also known to have an impact on fish and invertebrate abundances as do the deep-sea coral reefs in the North Atlantic (Leys et al 2004). Sponge reefs, like the deep-sea coral reefs, support rich and diverse assemblages of marine life, and are home to thousands of other species (CBD 2005a). A study of glass sponge skeletons in the inner basin of Howe Sound, British Columbia indicated past stressors in this area, which suggests that glass sponges may also be sentinel species for current and past seawater conditions where they are found (Leys et al. 2004).

III. EXISTING AND POTENTIAL IMPACTS OF SOME ACTIVITIES TO SELECTED SEABED HABITATS

A. Hydrothermal vents

34. The most immediate impact of anthropogenic activities on hydrothermal vents comes from research activities, which often involves repeated sampling, observation, and instrumentation of a small number of well-known hydrothermal vent sites, occurring at least once a year, and which may cause temporal changes at individual sites (Glowka 2003; CBD 2005a; Arico and Salpin 2005). Effects of biological and geological sampling operations on vent faunal communities have already been documented and may intensify, as vent sites become the focus of intensive, long-term investigation. Research activities and bioprospecting with adverse impacts, can cause removal of parts of the vent physical infrastructure and/or the associated fauna. Research vessels and scientific equipment for long-term measurements may also create a negative impact on the deep seabed physical environment. *In-situ* experiments may cause alterations in temperature, light, and noise. Pollution in the form of debris or

biological contamination can occur due to disposal of biological material from other areas (Arico and Salpin 2005; Leary 2007). Significant loss of habitat, and population oversampling due to bioprospecting, along with mining of polymetallic sulphide deposits associated with vent systems, and high-end tourism may cause future damage to vent ecosystems (CBD 2005a; Arico and Salpin 2005; Leary 2007).

35. Inactive vent fields are a target for mining. "Cold" sulphides have received little attention from biologists, but they can be covered by a substantial biomass of suspension-feeding corals, sponges, and other invertebrate types compared to that of the surrounding seabed. There is as yet no evidence that this is a specialized fauna, but there is evidence in at least one locale that this fauna is nourished by chemoautotrophic production, probably advected from nearby active vents. The impact of seabed activities on this fauna would seem to be comparable to impacts on seamount faunas (C.L. Van Dover, October 29, 2007).

36. There is no evidence whatsoever that human activity in the deep sea was responsible for a recently reported fungal epizootic in mussels in Fiji Basin (Van Dover et al. 2006), but this epizootic is a reminder that there is a potential role of human activities in the deep-sea with respect to transfer of pathogens and other microorganisms from one site to another. Invasive species distributed through ballast waters of research submersibles is not implausible (C.L. Van Dover, October 29, 2007).

B. Cold seeps

37. Seepages are potentially threatened by prospecting by the petroleum industry. The biological communities associated with these seeps are widespread and may be affected by physical disturbance caused by benthic trawling activities or destructive scientific investigation (Baker et al. 2001). Furthermore, since several patents already exist for the direct harvest of seepage minerals from point sources on the seabed, seepages may become subject to direct exploitation and be adversely impacted in the future, if high-grade mineral-laden fluids expelled from deep seabeds can be tapped (CBD 2006e).

C. Seamounts

38. Seamount fishes are characterized by a longer life span, later sexual maturation, slower growth, and lower natural mortality, which make them intrinsically more vulnerable to exploitation than other groups of fishes (Rogers 2004; Morato et al. 2006). Some seamount fishes form large, dense aggregations for reproduction, making them easy targets for trawlers and thus highly vulnerable to over-exploitation (Rogers 2004). Seamount trawl fisheries for deepwater species have often been of a "boom and bust" type (see Clark et al. 2007), with examples from around the world indicating that large volume fisheries are not sustainable. Stocks of orange roughy in Namibia were fished down to 10% of their virgin biomass in six years while in New Zealand, a number of stocks were fished down to 15-20% of virgin biomass in less than 15 years (Lack et al. 2003). Fisheries for alfonsino and scabbardfish declined from 12,000 to <2,000 t in just two years; and the catches for roundnose grenadier and orange roughy declined from 30,000 to <2000 t in about 15 years in the Mid-Atlantic Ridge (Morato et al. 2006). Given common biological characteristics of slow growth, high longevity, and low fecundity of many seamount fish species, as well as uncertain recruitment (Morato and Clark 2007), and the fragile nature of many reef-building deep-sea corals, it is likely that destructive deep sea fishing activities have already damaged many benthic seamount communities and reduced the distribution and abundance of associated species (Rogers 2004; Probert et al. 2007).

39. To date, human impacts on seamounts are mainly attributed to destructive fishing practices, including bottom-trawl fishing, fishing with bottom long lines and fish pots, which affect both target and non-target species, including corals, fish, and crustaceans, as well as the benthic communities of seamounts. The lost pots represent a long term threat as they continue to catch benthic animals. Trawl fisheries in particular can be highly destructive to benthic communities living on seamounts (Gianni 2004; Clark and Koslow 2007). On bottom-trawled seamounts, the coral framework is entirely destroyed, leaving bare rock and a markedly impoverished fauna behind (Koslow et al. 2001). It has been documented that losses of up to 98% of the coral cover of seamounts may be attributed to deep-sea bottom trawl fishing (Gianni 2004). Framework building corals can take thousands of years to grow into a

mature reef; recolonization and regrowth of areas impacted by fishing are likely to be slow, if they happen at all (Stone 2006). The apparently limited range of many seamount species means that the extinction of endemic seamount animals is also likely (Rogers 2004).

40. Other human impacts that could potentially negatively affect seamounts include: (i) global climate change, which may cause changes in sea temperatures, alterations in flows of ocean current, and changes in productivity patterns, to which cold-water corals may be extremely sensitive; (ii) direct physical damage from extractive mining activities which are becoming of commercial interest for Cobalt-rich ferromanganese crusts and polymetallic sulphides; (iii) removal of seamount species and increased sediment load due to mining activities, which are potentially highly destructive to marine life such as suspension feeders (Rogers 2004); and (iv) bioprospecting.

D. Cold-water coral and sponge reefs

41. Human activities impact cold-water coral reefs in a number of ways. For example, deep-sea coral and sponge habitats have been damaged due to destructive bottom fishing (Butler and Gass 2001 as cited in Puglise et al. 2005; Leys et al 2004). Additionally, damage may occur from hydrocarbon drilling and seabed mining, ocean acidification, placement of pipelines and cables, pollution, research activities with destructive impacts, and dumping (UNEP n.d.).

42. There is global evidence that these habitats have been damaged by trawling for deep-water fish, causing severe physical damage from which recovery to former reef status will take several hundreds or even thousands of years, if at all. On the other hand, there is little evidence that hydrocarbon exploitation substantially threatens cold-water coral ecosystems. The primary concern pertains to the possibility that drill cuttings could smother reef fauna, which, although localized, might cause local extinctions of endemic species.

43. There is general consensus that atmospheric carbon dioxide levels are rising sharply. Modeled scenarios suggest that this could cause the greatest increase in ocean acidification over the past 300 million years (Roberts et al. 2006). A report suggests that ocean acidification could result in corrosive chemical conditions that would be reached much sooner than previously thought. Within 50 to 100 years, there could be severe consequences for marine calcifying organisms, which build their external skeletal material out of calcium carbonate, the basic building block of limestone. Most threatened are cold-water calcifying organisms, including sea urchins, cold-water corals, coralline algae, and plankton known as pteropods–winged snails that swim through surface waters (Orr et al. 2005).

44. Current research predicts that tropical coral calcification would be reduced by up to 54% if atmospheric carbon dioxide doubles; the extent of this effect on cold-water corals is yet to be examined. In addition to the effects of ocean acidification, modelling studies predict that the depth at which aragonite dissolves could become shallower by several hundred meters, thereby raising the prospect that areas once suitable for cold-water coral growth will become unfavourable (Roberts et al. 2006).

45. Table 1 summarizes the existing and potential impacts of anthropogenic activities on selected seabed habitats, including specific examples.

Table 1. Summary of existing and potential impacts of anthropogenic activities on deep seabed habitats, including specific examples.

Seabed Habitat	Existing and Potential Threats
1. Hydrothermal vents	<u>Existing:</u> - Research activities and bioprospecting may cause removal of parts of the vent physical infrastructure and/or of the associated fauna; research vessels and scientific equipment for long-term measurements may also negatively impact the deep seabed physical environment; in-situ experiments may cause alterations in temperature, light, and noise; pollution in the form of debris or biological contamination due to disposal of biological material from other areas; frequency of research expeditions may intensify adverse impacts (Arico and Salpin 2005).

Seabed Habitat	Existing and Potential Threats
	Potential: - In the long-term, commercial exploitation of genetic material is a concern and may drive unsustainable collection of species (CBD 2006e) - A further theoretical, but as of yet unrealized, economic resource associated with hydrothermal vents is their potential use for generating hydrogen fuel (Bubis and Molochnikov 1993 as cited in FAO 2003); based on known potential adverse impacts from terrestrial geothermal plants, potential adverse impacts may include alterations in the marine environment caused by water, air, and solid waste pollutants and adverse impacts to thermophilic bacteria and other organisms (Defenders of Wildlife n.d.). - Deep-sea adventure tourism: A number of research vessels have taken small numbers of tourists to hydrothermal vent sites, e.g., in June 2002 deep-sea tourists were offered a month long cruise on the *R.V. Akademik Keldysh*, a Russian research vessel, and dives to several hydrothermal vent sites near the Azores for $20,000-$55,000 (FAO 2003; Leary 2006). The fee included participation as an observer on three Mir submersible scientific dives to three different hydrothermal vent sites which included Snake Pit, TAG, Broken Spur, Lost City and Lucky Strike hydrothermal vent sites. Russian scientists are also known to have taken deep-sea tourists to the Rainbow hydrothermal vent site (Dando and Juniper 2001 as cited in FAO 2003). Originally, these dives were operated by scientific research vessels and were intended as a source of additional funding for the research undertaken by these vessels. However, it appears that the tourist dives were organized by the Deep Ocean Expeditions LLC and are offered for adventure tourism as well as for public education; these dives are integrated into scientific dives, making them and their impacts indistinguishable from those of research activities. As these dives are a recent phenomenon, their potential adverse impacts are still unclear (FAO 2003; Leary 2006). - Deep seabed mining poses a threat in terms of physical damage in the area of operation and surrounding habitats, with inevitable disturbance to the associated ecosystems; mining activities at vents may also result in increased sedimentation and plume generation, and disturb the hydrothermal vent water circulation systems; deep water which is lifted to the surface during a mining operation has a high nutrient content that could lead to local or regional increases in primary productivity and associated impacts, including nutrient over-enrichment and resulting lack of oxygen, and changes in the structure of biological communities (UNEP 2006). It is to be noted, however, that mining is unlikely to take place on active hydrothermal vents, but rather at inactive spreading areas (M. Lodge, November 2007). - Mining equipment may tear out the ocean bottom, destroying the vent ecosystem (giant tubeworms and other fauna), while eliminating the elements necessary for rejuvenation (heat and organisms). Though exploration for hydrothermal deposits is non-intrusive, evaluation of the deposits for mineral resources requires a series of samples from drilled holes in the deposits. Ocean mining may also degrade the seabed through the release of toxic elements and loss of habitat (International Seabed Authority Workshop 2004).
2. Cold seeps	Existing: - As fishing and gas and oil operations continue to go farther offshore and deeper, disturbances to cold seep habitats will likely increase. - Damage to biological resources associated with research activities and bioprospecting in hydrothermal vents may have similar types of adverse impacts on organisms found in cold seeps. Potential: - The threats associated with mineral exploitation in cold seeps may be similar to those associated with mineral exploitation in hydrothermal vents.
3. Seamounts	Existing: - Fishing on seamounts is ongoing, especially in the Southern Oceans; impacts of fishing are not monitored; it is anticipated that heavily exploited stocks will be threatened with overexploitation; vulnerable benthic habitats are threatened by trawling (CBD 2006e). -Spatial concordance of fishable seamounts within the depth band of the orange roughy fishery indicated there could be further commercial exploration for orange roughy fisheries on seamounts in the central-eastern southern Indian Ocean, the southern portions of the Mid-Atlantic Ridge in the South Atlantic, and some regions of the southern-central Pacific Ocean;

Seabed Habitat	Existing and Potential Threats
	since these areas also contain habitat suitable for stony corals, impacts on deep-water corals, and on seamount ecosystems in general, are likely (Clark et al. 2006). Potential: - In the future, seamounts may be mined for ferromanganese crust and for strategic metals such as cobalt. Estimating the impact of future mining operations on seamounts is difficult due to a dearth of information on population dynamics of seamount organisms (Rogers 1995; Clark et al. 2006). - Seamounts are associated with low sediment levels and strong mixing along slopes with boundary currents that may prevent mining impacts from spreading. However, these factors would also result in sedimentation and prevent pollution dilution, resulting in a high impact locally. Crust exploitation of seamounts will result in sediment plumes and debris build-up at the base of the seamount, with mining resulting in high levels of dissolved nutrients in the water common. Endemism can be very high on some seamounts, and in such cases risk of biological diversity loss is great (seamounts have sometimes been referred to as “The Galapagos of the Deep”). Mining could potentially strip large areas, result in the loss of epifauna, release metals that affect benthic fauna, and effect water column processes (may enhance primary productivity or make environment toxic). Suspended sediments from commercial recovery of cobalt-rich crusts of seamounts may be a concern. Mining sulphide deposits may also result in the loss of fossil records (International Seabed Authority Workshop 2004) - Climate change-caused alteration in temperatures in the marine environment may adversely affect the biological functioning of seamount organisms; a potential reduction in thermohaline circulation that could occur with increased temperatures would limit the influx of oxygen-rich water to the deep seabed, which would kill much of the existing marine life in these unexplored areas. In addition, warmer waters could reduce the overall primary productivity within the oceans, leading to a decrease in organic matter that eventually falls to the seabed and supplies deep sea species with nutrients (UNEP/WCMC n.d.). Climate change and the level of carbon dioxide uptake by the oceans will also result in a shallowing of the aragonite saturation depth (which will affect the distribution of deep-sea corals), and also affect the distribution of animals reliant upon calcite (e.g. coccolithophores).
4. Cold-water coral and sponge reefs	Existing: - Damage to deep-sea coral habitats has occurred or may occur from fishing associated with bottom trawling, bottom-set fishing gears such as bottom long-lines and gill nets (Butler and Gass 2001 as cited in Puglise et al. 2005). Longlines and trawl nets frequently remove coral trees from rocks and boulders where they grow (Krieger and Wing 2002 as cited in Morgan et al. 2005). - The history of precious coral fisheries, mostly from seamounts, indicates that precious coral beds have frequently been depleted by overfishing (Rogers 2004). Potential: - Damage to deep-sea coral habitats may occur from oil and gas exploration and drill cuttings, mineral mining, cable laying, dredging, and sedimentation (Butler and Gass 2001 as cited in Puglise et al. 2005). - There is potential for bioprospecting for medicinal chemistry of deep-sea corals (DeVogelaere et al. 2005). Damage to biological resources associated with research activities and bioprospecting in hydrothermal vents may have similar types of adverse impacts on deep-sea coral organisms. - Ocean acidification poses a major potential threat to cold water coral reefs; global distribution of cold water corals appears to be influenced by the depth of the aragonite saturation horizon, below which corals will have difficulty laying down skeletal matrix. As atmospheric CO_2 levels increase, the depth of the aragonite saturation horizon shallows. It is estimated that around 70% of known cold water coral reefs globally will be affected by 2100 (AGO 2006).

IV. REVIEW OF PREVIOUS ANALYSIS OF OPTIONS FOR PREVENTING AND MITIGATING IMPACTS OF SOME ACTIVITIES ON SELECTED SEABED HABITATS

46. The note on marine and coastal biological diversity: status and trends of, and threats to, deep seabed genetic resources beyond national jurisdiction, and identification of technical options for their conservation and sustainable use (UNEP/CBD/SBSTTA/11/11), which was prepared in response to decision VII/5 (paragraph 54), considered by the eleventh meeting of the Subsidiary Body on Scientific, Technical and Technological Advice and subsequently by the eighth meeting of the Conference of the Parties, leading to decision VIII/21, identified available options for the protection of deep seabed genetic resources beyond the limits of national jurisdiction, including: (i) the use of codes of conduct, guidelines and principles; (ii) management of threats through permits and environmental impact assessments; and (iii) area-based management of uses, including through establishment of marine protected areas. The document provided technical descriptions of the options, the suitability of each option in addressing specific threats to seabed habitats, and examples of the application of each option. The document also described the policy framework under which the option could be implemented (CBD 2005a).

47. The United Nations General Assembly has addressed in recent years issues relating to the conservation and sustainable use of marine biodiversity, as well as the protection of vulnerable marine ecosystems and habitats, including those located in areas beyond national jurisdiction. Since 2002, the General Assembly encouraged relevant international organizations to consider urgently ways to integrate and improve, on a scientific basis, the management of risks to marine biodiversity of seamounts and certain other underwater features within the framework of UNCLOS. 6/ It has called upon States to improve the scientific understanding and assessment of marine and coastal ecosystems as a fundamental basis for sound decision-making through the actions identified in the WSSD Plan of Implementation. 7/ It also invited the relevant global and regional bodies, in accordance with their mandates, *inter alia*, to investigate urgently how to better address, on a scientific basis, including the application of precaution, the threats and risks to vulnerable and threatened marine ecosystems and biodiversity in areas beyond national jurisdiction; and how existing treaties and other relevant instruments could be used in this process consistent with international law, in particular with UNCLOS and with the principles of an integrated ecosystem-based approach to management, including the identification of those marine ecosystem types that warrant priority attention; and to explore a range of potential approaches and tools for their protection and management. Upon the recommendations of the fifth meeting of the Consultative Process, 8/ the Assembly reiterated its concern over the adverse impacts of a number of human activities on the marine environment and biodiversity, in particular on vulnerable marine ecosystems, 9/ and called 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. 10/

48. During its meeting on 13-17 February 2006, participants at the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction established by the General Assembly stressed the need for, among others: (i) implementation of existing instruments through increased cooperation and coordination; (ii) integrated management approaches and the use of the precautionary and ecosystem approaches using the best available science, and prior environmental impact assessments; (iii) area-based management measures, including representative networks of marine protected areas; (iv) marine scientific research;

6/ A/RES/57/141, para. 56. The call was reiterated in A/RES/58/240, para. 51 and A/RES/59/24, para. 68, which broadened the call also to States and included cold water corals and hydrothermal vents as ecosystems of concern.

7/ General Assembly Resolution A/RES/58/240, adopted on 23 December 2003, para. 49.

8/ Report on the work of the United Nations Open-ended Informal Consultative Process, A/59/122, para. 2.

9/ General Assembly Resolution A/RES/59/24, adopted on 17 November 2004, preambular paragraphs.

10/ A/RES/59/24, paras 69-70; see also A/RES/59/25; A/RES/61/105.

and (v) capacity building and transfer of marine technology (UNGA 2006b). As mentioned above, the eighth meeting of the Consultative Process addressed "marine genetic resources". Scientific, technical, economic, environmental, legal and socio-economic aspects of marine genetic resources raised during the discussions formed the basis of the Co-Chairpersons' possible elements to be suggested to the General Assembly (UNGA 2007d). These issues will be further discussed at the second meeting of the Working Group. As decided in General Assembly resolution 61/222, paragraph 91, the meeting will focus its discussion on the environmental impacts of anthropogenic activities on marine biological diversity beyond areas of national jurisdiction; coordination and cooperation among States as well as relevant intergovernmental organizations and bodies for the conservation and management of marine biological diversity beyond areas of national jurisdiction; the role of area-based management tools; genetic resources beyond areas of national jurisdiction; and whether there is a governance or regulatory gap, and if so, how it should be addressed.

49. In this note, the options identified in the SBSTTA-11 document are further examined for their applicability in deep-seabed habitats in areas beyond national jurisdiction. Known and documented applications of these options as well as options under development are also described.

V. FURTHER ANALYSIS AND EXPLORATION OF OPTIONS FOR PREVENTING AND MITIGATING THREATS TO SEABED HABITATS

50. Management of natural resources involves the use of a variety of tools and approaches that include, but are not limited to, information technologies, research, planning, regulation, protected areas, restoration, and coordination. These tools and approaches are applied in order to achieve specific management, ecological, and socioeconomic objectives. In integrated coastal and ocean management, the fundamental goals of reducing or preventing adverse impacts of human uses and maintaining or improving ecosystem health may be broken down into specific management objectives that include the ecological objectives of maintaining the followings: (i) biodiversity; (ii) species distribution; (iii) species abundance; (iv) primary production and reproduction; (v) trophic interactions; (vi) mortalities below thresholds; (vii) species health; (viii) water and sediment quality; and (ix) habitat quality (UNESCO 2006a). These are the ultimate objectives against which current and proposed management options and strategies for seabed habitats could be assessed.

51. A brief description of the current legal framework and key stakeholder groups which play major roles in the management of seabed habitats herewith provides the context in the current and future implementation of these options for preventing and mitigating threats to seabed habitats.

A. Management tools in international instruments

52. Legally binding and non-binding instruments were scanned for management and conservation techniques potentially applicable 11/ to deep seabed habitats as summarized in annex I. The list is not exhaustive, but rather illustrative of these techniques. In particular, some of these management tools and approaches are also provided in UNCLOS and/or the 1995 United Nations Fish Stocks Agreement, including protection of habitat, creation of protected areas, provision of technical and financial assistance, environmental impact assessments, and cooperative arrangements. Management measures currently in use are mostly sectoral, i.e., those used for fishing (through FAO and RFMOs), shipping (through IMO), and mining (through the ISA).

53. IMO has developed a framework of global instruments, programmes, which provide a platform for sustainable shipping. Parties to IMO treaties are under the obligation to enforce jurisdiction on ships flying their flag, irrespective of the maritime zone where the ships may be. Accordingly, the differences of legal status between the territorial sea, the EEZ and the high seas do not directly influence the way

11/ By scanning previously implemented programmes, potentially applicable techniques are identified and determined to have functioned effectively or successfully in their respective areas of application through the use of indicators or other measures of effectiveness.

safety and anti-pollution measures on board is implemented. Hence the measures implemented are equitable to both coastal and high seas biodiversity protection.

54. These management techniques have been adopted and applied in the marine realm with varying success. Birnie and Boyle (2002) discuss a sampling of these techniques and provide some insights into the efficacy of each. Although the array of management tools found in international and regional environmental conventions and other agreements looks impressive, in reality, enforcement options are limited in areas beyond the limits of national jurisdiction under existing international and regional legal instruments. Furthermore, the application of these management techniques to marine areas beyond the limits of national jurisdiction is still relatively new and at the exploratory stage (Henriksen et al. 2006; J. Batongbacal, personal communication, April 2007).

55. The more common management options used in areas within national jurisdiction, such as codes of conduct, principles and guidelines, permits and EIA, and marine protected areas, have been identified to be of potential applicability in areas beyond the limits of national jurisdiction, and are considered in greater detail in this note. It should be noted that some of these management options, such as codes of conduct and area-based management tools, are already being applied in marine areas beyond the limits of national jurisdiction, as indicated in table 2.

56. Although most of the techniques may be currently in use within areas under national jurisdiction, their management function could be considered for use in areas beyond the limits of national jurisdiction. The selection and determination of applicable conservation techniques in addressing impacts to deep seabed habitats needs to be undertaken within the context of existing legal regimes for the high seas and the Area, and within a comprehensive strategic planning process where goals, purposes, and expected outputs are adopted by stakeholder consensus, with consideration of the important events, conditions, or decisions necessary for achieving and sustaining objectives in the long term. The process of selecting and adopting the techniques appropriate for the conservation of deep seabed habitats could be done systematically through the use of logical frameworks 12/ (Scottish Executive 2002). Some questions to be considered include: what are the management and conservation techniques that could be undertaken within the current legal framework in the short-term, and what other management and conservation techniques could be added? Table 2 shows some of the options that are in place, indicating the dearth of available techniques.

12/ Logical frameworks are planning tools used to obtain the necessary coherence and logic between the hierarchy of objectives in the development of integrated coastal and ocean management plans (Scottish Executive 2002).

Table 2. Summary of status and impacts of activities on selected deep seabed habitats beyond the limits of national jurisdiction and corresponding management options (modified from CBD 2005a)

Value and Importance	Existing and Potential Impacts of Some Activities	Existing[e]/Under Development[u] Options
1. Hydrothermal vents		
- Hydrothermal vents are characterized by high acidity and extreme salinity and toxicity on which depend the microorganisms at the lower trophic levels of the hydrothermal vents' food chains. - Wide variety of bacteria and archaea use sulphur, hydrogen, methane, and other compounds released by the reactions between seawater and magma beneath the mid-ocean ridge system and other centres of seafloor volcanism for primary production. - -The archaea have specialized enzymes that allow them to cope with and thrive in extreme levels of temperature and pressure - of great interest to the biotechnology community for potential industrial applications, particularly because of their adaptation to a high pressure/high temperature environment - There are 471 recorded species in hydrothermal vents, of which 91% are known to inhabit vents only. Molluscs (29%), crustaceans (33%), and polychaetes (17%) are the prevailing groups. - Microbes account for the majority of genetic and metabolic variations in the oceans and that the genetic diversity, community composition, relative abundance, and distribution of microbes in the sea remain under-sampled and essentially unexplored - Contribute to the cooling of the planet as a whole, to its thermal balance, and to the chemical balance of the oceans and the atmosphere	Existing: The research community is initiating self-policing activities on impact of research activities so it is anticipated in the short-term that impacts from research may decline; in the long-term, commercial exploitation is a concern and may drive unsustainable collection of species. Potential: Habitat degradation due to biotechnology exploitation, deep-sea mining, geothermal energy, and deep-sea adventure tourism.	- Code of conduct for marine scientific research (InterRidge 2006) [e] - German Senatskommission für Ozeanographie of the DFG and the German Marine Science Research Consortium KDM, Commitment to Responsible Marine Research[e] - Code of Conduct for MPAs in the Azores Triple Junction [u] - Voluntary Guidelines on Biodiversity-Inclusive EIA [e] - International Seabed Authority (ISA) draft regulations on prospecting and exploration for polymetallic sulphides and cobalt-rich ferromanganese crusts in the Area 13/; ISA exploration and mine site model to block selection for cobalt-rich ferromanganese crusts and polymetallic sulphides 14/ - Regulation/mitigation activities by States

13/ ISBA/10/C/WP.1Rev.1; ISBA/13/LTC/WP.1

14/ ISBA/12/C/3

Value and Importance	Existing and Potential Impacts of Some Activities	Existing[e]/Under Development[u] Options
- Role in the origin of life - Contribute to ascending organic matters that support upper zooplankton communities - Participate in the global carbon cycle since the organic substance originating from hydrothermal vents supports the transfer of energy through resident species and perhaps through upper water column species		
2. Cold seeps		
- Cold seep ecosystems harbour communities dominated by symbiont-bearing tubeworms, mussels, and clams, often belonging to genera found earlier at hydrothermal vents - Only a small fraction of existing seafloor seeps have been so far discovered - Seep communities exist at depths between <15 m to >7,400 m from all oceans of the world except the Polar regions - Cold seep communities produce organic carbon in large quantities through microbial chemosynthesis, which leads to the large size of the fauna and the high biomass of the communities supported by cold seeps - Cold seeps are characterized by a wide range of geological and sedimentary forms, including gas bubbles, microbial mats, pockmarks, carbonate platforms and mounds, reef-like communities, mud volcanoes and ridges, gas hydrates, and hypogenic caves - Megafaunal heterogeneity depends on geological structures - Spatial heterogeneity of microbes and higher organisms is extensive at seeps - Specialized infaunal communities are associated with different seep habitats and with different vertical zones in the sediment - Vestimentiferan tubeworms, entirely reliant on internal sulphide-oxidizing chemoautotrophic bacterial symbionts for their nutrition, form aggregations of hundreds to thousands of individuals and harbour a diverse community	<u>Existing:</u> As fishing and gas and oil operations continue to go further offshore and deeper, disturbances will likely increase. Research activities <u>Potential:</u> Habitat degradation due to biotechnology and mineral exploitation.	- States and RFMO initiatives[eu] - FAO Code of Conduct for Responsible Fisheries (FAO 1995)[e] - Voluntary Guidelines on Biodiversity-Inclusive EIA[e] - Micro-Organisms Sustainable Use and Access Regulation International Code of Conduct (MOSAICC)[e] - Code of Practice for Ocean Mining (IMMS 2002)[e] - International Seabed Authority (ISA) draft regulations on prospecting and exploration for polymetallic sulphides and cobalt-rich ferromanganese crusts in the Area; related exploration and mine-site model[u]

Value and Importance	Existing and Potential Impacts of Some Activities	Existing[e]/Under Development[u] Options
of associated species. - Cold seeps demonstrate the mechanisms that enable marine organisms to survive high sulphide levels - Fossil seeps are important in confirming that chemosynthesis-based paleoenvironments have been diverse and variable throughout earth's history in terms of both geologic settings and taxonomic compositions - Paleobiogeographic data also help explain current distribution patterns of vent-seep taxa worldwide - Ancient vents and seeps reveal the evolution of organisms living in extreme environments		
3. Seamounts		
- Large seamounts could number between 14,000-100,000 worldwide with just over half of them located in areas beyond the limits of national jurisdiction. - Seamounts may form biological hotspots with a distinct, abundant and diverse fauna, and sometimes contain many species new to science. They offer benthic animals a wide depth range in an otherwise deep ocean, and may be important as stepping stones for faunal dispersal. - The fauna of seamounts may have a very limited distribution restricted to a single geographic region, a seamount chain, or even a single seamount location. - Seamount communities are often associated with biological habitats such as deep-water coral reefs, which present additional complexity to the seamount environment. - Seamounts can form eddies of water which can entrain animals and larvae on the seamount summit, and can also be associated with upwellings of nutrient-rich waters. - Seamounts and the water column above them serve as important habitats, feeding grounds, and reproduction sites for many open ocean and deep-sea species of fish, sharks, sea turtles, marine mammals, seabirds, and benthic organisms of great variety.	<u>Existing:</u> High seas fishing on seamounts ongoing, especially in the Southern Ocean; impacts are not monitored; heavily exploited stocks are expected to be threatened with overexploitation; vulnerable benthic habitats are threatened by trawling. <u>Potential:</u> Mining of ferromanganese oxide and polymetallic sulphides	- FAO Code of Conduct for Responsible Fisheries (FAO 1995) and its relevant International Plans of Action[e] - FAO International Guidelines for the Management of Deep Sea Fisheries in the High Seas[u] - Regional Fisheries Management Organizations' initiatives in limiting fishing in seabed habitats (South Pacific RFMO and the Northwest Atlantic Fisheries Organization)[e] - Cooperative agreements or arrangements of mutual assistance on a global, regional, subregional or bilateral basis[e] - Code of practice for ocean mining (International Marine Minerals Society 2002) [e] - ISA International Seabed Authority (ISA) draft regulations on prospecting and

Value and Importance	Existing and Potential Impacts of Some Activities	Existing[e]/Under Development[u] Options
- Seamounts support a large and diverse fish fauna of up to 798 species. - Deep-water trawl fisheries over seamounts target 20 major species. - Pelagic fisheries also occur over seamounts, mainly for tunas and black scabbardfish. - Total historical catch from seamounts has been estimated at over 2 million tons.	Climate change	exploration for polymetallic sulphides and cobalt-rich ferromanganese crusts in the Area; related exploration and mine site model - Voluntary Guidelines on Biodiversity-Inclusive EIA[e] - Mitigation activities carried out on the continents and islands by States[e]
4. Cold-water coral and sponge reefs		
- The scale and abundance of cold-water corals cover a wide range that includes individuals, isolated colonies, small patch reefs, large reefs, and giant carbonate mounds of up to 300 m high and several kilometres in diameter - Because of their age and slow growth rates, reefs contain high-resolution records of long-term climate change - Important speciation centres in the deep sea - Biodiversity in cold-water corals, because of habitat complexity, is comparable with that found in tropical coral reefs. Over 1,300 species have been reported living in *Lophelia pertusa* reefs in the Northeast Atlantic. - Cold-water coral and sponge reefs provide habitat, feeding grounds, recruitment, and nursery areas for deep-water organisms, including commercial fish species - Glass sponges may also be sentinel species for current and past seawater conditions where they are found	Existing: Fishing on coral and sponge reefs or adjacent to them with consequential damage still occurs, especially in areas beyond the limits of national jurisdiction. As fisheries continue to move further offshore and into deeper waters, the threat to these habitats beyond the limits of national jurisdiction will continue. Pipeline installation activities Potential: Habitat degradation due to biotechnology-driven research	- FAO Code of Conduct for Responsible Fisheries (FAO 1995) and its relevant International Plans of Action [e] - Management measures developed by Regional Fisheries Management Organizations [e] - Cooperative agreements or arrangements of mutual assistance on a global, regional, subregional or bilateral basis, e.g.: NAFO and CCAMLR [e] - Environmental impact assessment (EIA) and mitigation measures adopted by oil and gas companies as stated in environmental impact statements [e] - Code of Practice for Marine Scientific Research in Cold Water Corals15 - Voluntary Guidelines on Biodiversity-

15/ Irish Department of the Environment, Heritage and Local Government 2006

		Inclusive EIA[e]
	Gas and oil platforms can damage corals	- The IMO Code for the Construction and Equipment of Mobile Offshore Drilling Units, 1989 (MODU Code) - Good and Best Practices for Offshore Oil and Gas Operations[e] 16/
	Climate change	- Mitigation activities carried out on the continents and islands by States [e] - Building resilience into coral reef MPA programs [u]

16/ Energy and Biodiversity Initiative 2003

B. Stakeholders in the management and conservation of seabed habitats

57. The development of a logical framework involves identifying the appropriate stakeholders 17/ to be involved in the application of each management option through a stakeholder analysis. The information generated by a stakeholder analysis could also be used to develop enhancement mechanisms in the existing management or governance structure for the areas beyond the limits of national jurisdiction.

58. A report by the United Nations University-Institute of Advanced Studies (UNU-IAS) provides preliminary information on stakeholders' uses of spaces and resources in open ocean and deep sea environments, which include: shipping, capture fisheries and aquaculture, research activities (for research, monitoring, educational or bioprospecting purposes), tourism, oil and gas extraction, mining, deep sea cable and pipeline industry, disposal of nuclear waste or other substances, military uses, and ocean uses by indigenous and local peoples (Vierros et al. 2006). Each of these uses may affect the ecosystem differently; each may have impacts on one or more components of the ecosystem; and there may be different stakeholders operating for each of them. The UNU-IAS report stresses the importance of identifying the different stakeholders involved, their inherent characteristics relevant to the uses they are identified with, including potential impacts on the ecosystem, in order to come up with viable management approaches that consider all information. For marine areas beyond the limits of national jurisdiction, it may be appropriate to identify the stakeholders in each deep seabed habitat based on the current uses and activities affecting each (see table 3).

Table 3. Preliminary list of stakeholders of the deep seabed.

Selected Seabed Habitat	Stakeholders 18/
1. Hydrothermal vents	Current: - Organizations undertaking research activities, including academic, research, and private/commercial institutions - Biotechnology companies (few): for example pharmaceuticals, botanical medicines, horticulture and crop protection - High-end tourism operators and tourists (still few but growing in number) - Relevant UN organization/s including the International Seabed Authority, regional organizations including the Regional Fisheries Management Organizations (RFMOs) - Developed and developing States, coastal nations, flag States - non-governmental organizations Potential: - - Deep sea mining companies - Energy development companies
2. Cold seeps	Current: - Oil and gas companies - Organizations undertaking research activities - Relevant UN organization/s including the International Seabed Authority, regional organizations including the Regional Fisheries Management Organizations (RFMOs)s - non-governmental organizations - Developed and developing States, coastal nations, flag States

17/ Stakeholders are "individuals, groups or organisations that are affected by and/or have an interest in a particular issue" (PCE n.d.).

18/ Key actors who are responsible for or are relevant to the implementation of options.

Selected Seabed Habitat	Stakeholders 18/
	Potential: - Biotechnology companies - Deep sea mining companies
3. Seamounts	Current: - Fishermen and fishing industry - Relevant UN organization/s including the FAO, Convention secretariats, International Seabed Authority, regional organizations including the Regional Fisheries Management Organizations (RFMOs) - Flag States - Non-governmental organizations - Developed and developing countries, coastal nations, flag States - Fish consumers - Deep sea mining companies for ferromanganese crusts Potential: - Deep sea mining companies for other minerals - Biotechnology companies - Scientific researchers
4. Cold-water coral and sponge reefs	Current: - Fishermen and fishing industry - Relevant UN organization/s including the International Seabed Authority, regional organizations including the Regional Fisheries Management Organizations (RFMOs) - Flag States - Companies that use/lay cables and pipelines - Nongovernmental organizations - Developed and developing countries, coastal nations, flag States - Fish consumers Potential: - Scientific researchers - Biotechnology companies - Oil and gas companies, and end users of oil and gas

C. Applicability of management options to seabed habitats

59. This section focuses on non-regulatory aspects of management options, scientific and technical, that may be used in mitigating preventable impacts to seabed habitats arising from existing and potential uses, including: (i) codes of conduct and guidelines; (ii) permits and Environmental Impact Assessment (EIA); (iii) area-based management tools, including establishment of marine protected areas; and (iv) ecosystem-based and integrated management approaches. Brief overviews of the policy context in which the management options are embedded are provided at the beginning of the discussion on each option.

1. Codes of conduct, guidelines, and principles

60. Principles underpin the guidance provided in various instruments. In marine areas beyond the limits of national jurisdiction, several international legal instruments provide guiding principles, such as on sustainable use of marine biodiversity/resources; equitable and efficient utilization of ocean resources and conservation and management of marine living resources; precautionary approach; ecosystem approach; duty not to cause damage to the environment beyond the limits of national jurisdiction, including rare/fragile ecosystems; prior the environmental impacts assessment (EIA); transparency and accountability; stakeholder participation; and international cooperation, whether in fisheries conservation and management, marine scientific research, and/or environmental protection and preservation (e.g., 1979

Bonn Convention; 1982 UNCLOS; 1986 Noumea Convention; 1992 Convention on Biological Diversity; 1994 Agreement relating to Part XI of UNCLOS; 1995 Fish Stocks Agreement) (Kimball 2006).

61. Guidelines are standards or principles by which to make judgments, determine policies, or decide on a course of action (Webster's New World 1991). Guidelines could come in the form of documents produced by regulatory agencies to accompany regulations and acts that provide the steps an individual should follow with respect to a given act or regulation. They are not enforceable by law, but failure to abide by them may result in actions contrary to an act or regulation, which is enforced by law (BioBasics 2007). UNEP has developed and adopted guidelines on compliance with and enforcement of multilateral environmental agreements (UNEP 2001). The guidelines, which are advisory, provide approaches for enhancing compliance with multilateral environmental agreements (MEAs) and for strengthening the enforcement of laws implementing those agreements. In recognition that parties to MEAs are best situated to choose and determine useful approaches in the context of specific obligations contained in the agreements, the non-binding guidelines may inform and affect how parties implement their obligations under the agreements, though they do not in any manner alter these obligations (UNEP 2001).

62. IMO adopted the International Convention on the Control and Management of Ships' Ballast Water and Sediments on 13 February 2004. The purpose of the Convention is to prevent, minimize and ultimately eliminate the risks to the environment, human health, property and resources arising from the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments. Since then, 14 sets of Guidelines have been developed and adopted by IMO, including Guidelines for ballast water exchange in the Antarctic Treaty area, which provide common guidance for all vessels undertaking ballast water exchange in Antarctic waters. FAO is also currently developing International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. 19/

63. Codes of conduct are among the management options being considered for use in addressing the threats to marine areas beyond the limits of national jurisdiction and the resources therein (CBD 2005a; UNGA 2006b). Codes of conduct provide guidance to users in on-the-job decision-making by clearly stating the guidelines on the steps an individual should follow with respect to a given act or regulation, which are based on principles or standards of acceptable behaviour. They are meant to clearly state an organization's mission, values, and principles associated with standards of professional conduct (ERC 2006).

64. A well-written code of conduct communicates the commitment that an organization has made to uphold its most important values, dealing with such matters as its commitment to employees, its standards for doing business, and its relationship with the community (Driscoll et al. 2000 as cited in ERC 2006). The provisions of a code of conduct depend on the organization's purpose for adopting the codes. A code is intended to support the enforcement of relevant standards, policies, and rules, not to serve as a substitute for them (ERC 2006). Codes of conduct also present an opportunity "for responsible organizations to create a positive public identity for themselves which can lead to a more supportive political and regulatory environment and an increased level of public confidence and trust among important constituencies and stakeholders" (ERC 2006) or, in the case of tourism, a manoeuvre to avoid external regulation (Mason and Mowforth 1996 as cited in Mason 1997).

65. Codes of conduct can be developed and applied as a measure in the absence of laws and management plans, usually developed by the industries or sectors concerned, such as in the case of research activities and bio-prospecting (Santos et al 2003; Arico and Salpin 2005). Codes of conduct may also be used to enhance the implementation of an existing legal framework or used as self-regulatory measures (UNGA 2006b). A review of literature in the field produced some examples of codes of conduct currently in use, such as: 1) the FAO Code of Conduct for Responsible Fisheries, a framework instrument; 2) Code of practice for marine scientific research in cold-water corals, an instrument of a

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19/ FAO will be holding a Technical Consultation on International Guidelines for the Management of Deep-Sea Fisheries in the High Seas in Rome, Italy 4 February 2008 - 8 February 2008 (http://www.fao.org/fi/website/FIRetrieveAction.do?dom=topic&fid=16000)

regional directive; 3) Code of conduct for hydrothermal vent research; 4) Code of practice for ocean mining; 5) Good and best practices for offshore oil and gas operations; and 6) the Micro-Organisms Sustainable use and Access regulation International Code of Conduct (MOSAICC), which are all briefly described in annex III.

66. In addition, a voluntary code of conduct was proposed among the measures put forward in the Workshop on Planning the Management of Deep-sea Hydrothermal Vent Fields Marine Protected Areas in the Azores Triple Junction, 18-20 June 2002, Horta, Portugal (Santos et al. 2003; Arico and Salpin 2005). The elements of the proposed code of conduct were discussed, including goals and scope of activities to be covered (scientific research, fisheries, tourism, and commercial exploitation) as well as mode of dissemination (Santos et al. 2003). The main provisions of the proposed code include: (i) research activities should be undertaken in accordance with the approved marine protected areas (MPA) Management Plan and any other local and international regulations; (ii) no experimental and commercial fisheries should take place inside the MPA; (iii) tourist access should be prohibited in experimental areas and highly sensitive areas; and (iv) commercial mineral, geothermal and biotechnological exploitation shall be forbidden inside the MPA (Santos et al. 2003). Information is yet to be obtained as to whether the code has been finalized and adopted. There is also a German scientific code of conduct developed by the Senatskommission für Ozeanographie of the German Research Foundation (DFG) and the German Marine Science Research Consortium (KDM) Commitment to Responsible Marine Research. The Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention) is also currently developing a code of conduct for scientific research, which includes bioprospecting. A draft version, as developed by an inter-disciplinary correspondence group, was presented to the OSPAR Marine Protected Areas Species and Habitats (MASH) Working Group in early November 2007.

67. The IMO Code for the Construction and Equipment of Mobile Offshore Drilling Units, 1989 (MODU Code), recommends design criteria, construction standards and other safety measures for mobile offshore drilling units so as to minimize not only risks to such units and to the personnel on board, but also environmental risks which could arise from a collision between vessels and offshore installations and structures, equivalent to that required by the 1974 International Convention for Safety of Life at Sea, as amended, and the 1966 International Convention on Load Lines, as amended, for conventional ships engaged in international voyages (IMO 2001).

68. There are also codes of conduct of potential application to high-end ship-borne tourism on the high seas, which are currently directed at tourists (e.g., Code of Conduct for Arctic Tourists) or tourist operators (Code of Conduct for Tour Operators in the Arctic) on the Arctic or Antarctic (Mason 1997; Bauer 2001; WWF 2006a).

69. Since reports that could provide information on the effectiveness of the above codes of conduct are lacking, a rough assessment of the presence or absence of elements considered to be important for codes of conduct to be successful is presented in Table 4.

Table 4. Analysis of code of conduct with regard to effectiveness elements

Elements/Code	**Ocean mining** 20/	**Fisheries** 21/	**Offshore Oil and Gas**22/	**Hydro-thermal Vent Research** 23/	**Cold-water Coral Reef Research** 24/	**Microbial Genetic Resources** 25/
Clear definition of issue being addressed	x	x	x	x	x	X
Clear definition of goal/purpose/objective of adopting a code of conduct	x	x	x	x	x	x
Logical connection between the issue/s being addressed, the objectives set to address the issue/s, and the guidelines contained in the code of conduct	x	x	x	x	x	x
Target users clearly identified	x	x	x	x	x	x
Wide dissemination of the code of conduct among its target users	o	x	o	x	o	x
Provision of support in the form of training and job aids in the use of the code	o	x	x	o	o	x
Wide acceptance of the code among target users	o	x	o	x	o	x
Incentives for individual/group adoption of the code	o	o	o	o	o	x
Peer pressure in the application of the code	o	o	o	x	o	x
Monitoring and evaluation on the use of the code	x	x	o	o	x	o
Provision of option for revision and adjustment	x	x	x	o	o	o

Legend:
x – There is evidence that the particular element is present in the code.
o – There is no evidence that the particular element is present in the code.

20/ Code of Practice for Ocean Mining

21/ FAO Code of Conduct for Responsible Fisheries

22/ Good and Best Practices for Offshore Oil and Gas Operations

23/ InterRidge Code of Conduct for Hydrothermal Vent Research

24/ Code of Practice for Marine Scientific Research in Cold-Water Corals

25/ Micro-Organisms Sustainable use and Access regulation International Code of Conduct

70. The codes of conduct examined in this note all meet the following elements: clear definition of issues addressed, clear objectives and guidelines, logical connection between issues addressed and objectives, and clear identification of their target clientele (table 4). However, codes of conduct, by their voluntary nature, rely heavily on the target clients' acceptance of their utility, the clients' understanding of the benefits to be derived in their application, and ease of use. It is therefore important for codes of conduct to have: components for training in the use of the code (e.g., FAO training and education activities on the use of its Code of Conduct for Responsible Fisheries); the provision of job aids (e.g., the MOSAICC flowchart and sample forms); a clear statement of the benefits to be derived with the use of the code (e.g., benefit-sharing terms in MOSAICC brochure); and wide dissemination of the code among their target users (e.g., print and electronic dissemination of Code of Conduct for Responsible Fisheries, MOSAICC, and InterRidge code of conduct in hydrothermal vent research). One characteristic to be noted is the participatory approach used in the development of the InterRidge code for hydrothermal vent research and the MOSAICC code for microbial genetic resources use and access, which facilitated the understanding, adoption, and application of the codes by their target users. On the other hand, the development of the codes of conduct for responsible fisheries, ocean mining, and oil and gas exploration benefited from accumulated experience and knowledge derived from long years of practice in the management of impacts from those industries.

71. It is also important for a code to have flexibility and provisions for monitoring, evaluation, and adjustment. Although a number of the codes have provisions for adjustment (codes of conduct for fisheries, mining, and offshore oil and gas), no report seems to have been produced on the assessment of their effectiveness. As the introduction on the use of best practices on oil and gas operations indicates, as new approaches and technologies become available, companies may raise the bar in terms of standards of practice. However, "in all cases, full and complete compliance with all applicable laws and regulations must be the starting point…" (EBI n.d.). In other words, codes of conduct are best used to encourage voluntary compliance with the existing legal framework governing the exploitation of resources. In the absence of clearly established international obligations, the codes of conduct temporarily fill the gap to deter over-exploitation and minimize adverse impacts.

2. Applicability of codes to the management and conservation of seabed habitats

72. Would codes of conduct be effective in preventing and mitigating the adverse impacts of anthropogenic activities on seabed habitats? To help answer this question, the InterRidge Statement is assessed using a set of questions as shown in box 1.

Box 1. Initial assessment of the effectiveness of the InterRidge Statement in preventing and mitigating the adverse impacts of anthropogenic activities on hydrothermal vents.

The *InterRidge Statement* is assessed using a set of questions 26/ as follows:

1) Is the code of conduct having any effect on the incidence of misconduct and inappropriate behaviour in research activities in hydrothermal vents?

No publication was found that could provide information on this question, which is inherently difficult given that any changes in behaviour among hydrothermal vent researchers, if observed, would be difficult to attribute to this code of conduct. This question would require carrying out a major and complex research study. The difficulty is due to factors that may affect the results, such as a commitment in management to integrity and a shift in the community's attitude and expectations (Boyd 2004), among others.

During the eighth meeting of the UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea, reference was made to the InterRidge Statement. It was underlined at that

26/ Adopted from *Ethics - Do Codes of Conduct Work?* (Boyd 2004).

meeting that a code of conduct is an effective and useful mechanism for the protection of hydrothermal vents against the adverse impacts of research activities but no data were provided to support this claim (UNGA 2007d).

An observer programme conducted periodically would be necessary to document the behaviour of hydrothermal researchers while on joint research expeditions by the researchers themselves. This would generate data through time and could be used to produce generalizations on the effect of the code of conduct on the behaviour of hydrothermal vent researchers.

Codes of conduct themselves might not have significant effect on the incidence of misconduct while doing scientific investigations in hydrothermal vents. However, they provide a documented minimum benchmark of expected behaviour among InterRidge collaborating organizations, to help communicate InterRidge's expected ethical standards and if necessary a reference against which penalties or sanctions on violators could be imposed. Without such a reference, attempts to penalize violations could fail, due to claims by researchers that they were unaware of the InterRidge's expected standards. Penalties might include cancellation of benefits, e.g., access to international sharing of data, ideas and samples, derived from membership with InterRidge.

2) What are the resource implications with respect to the introduction and maintenance of this code of conduct?

A program, dedicated to the introduction and maintenance of a code of conduct would ideally have resources for the following activities:

- Drafting of the code
- Consulting with hydrothermal vent researchers on the code
- An introduction strategy involving researcher training
- An ongoing ethics awareness programme for hydrothermal vent researchers
- Investigations of allegations of misconduct (breaches of the code) among hydrothermal vent researchers, and
- Implementation of any consequent disciplinary actions, penalties, or sanctions.

In the case of the *InterRidge Statement*, there does not seem to be any programme dedicated to its implementation after its adoption. The drafting of the code could be a "once-only resource cost". However, the rest of the activities would be recurring and would need maintenance costs. For example, as new investigators join the field of hydrothermal vent research, they would have to undergo an orientation session on the application of the code. Current researchers may need to be reminded of the protocol recommended or guidance provided by the code. Furthermore, as information on the nature of hydrothermal vent ecosystems and their health becomes available, the code may have to be revised accordingly. The possibilities of imposing penalties for violations would have to be considered by collaborating organizations and by the InterRidge management, which would also entail costs.

3) How does this code of conduct measure up when assessed as to whether it has provisions for maintenance and reinforcement of its use?

A guide, adopted from Boyd 2004, may be applied to the *InterRidge Statement*. It consists of the following steps:

a. Ensure researchers are involved in the development of the code of conduct
b. Incorporate the code of conduct within an overall ethics training program
c. Build training around scenarios, case-studies and examples with participative activities requiring reference to the code of conduct
d. Provide researchers with a range of decision-making processes to help solve ethical

dilemmas

e. Develop and adopt an overall "ethics regime" strategy incorporating the values contained in the code of conduct.

f. Avoid the ethics "flea dip", i.e., the ethical culture that InterRidge is promoting may not be mirrored by the collaborating organizations

g. Consider you are introducing an organizational culture change, rather than a mere internal control process

h. Monitor and transparently share progress of your organisation's ethical progress

i. Provide positive reinforcement – highlight champions

j. Lead from the top

Aside from Step a, it cannot be determined how the *InterRidge Statement* fares against the rest of the steps. There was some discussion at the eighth meeting of the Consultative Process where some delegations welcomed the initiatives of the scientists in the formulation and adoption of the InterRidge code of conduct for research at deep-sea hydrothermal vents as well as programmes such as Mar-Eco, an element of the Census of Marine Life, which demonstrated that scientists had an incentive to protect the sites they studied. They considered codes of conduct an effective means for promoting responsible research practices. It was also reported at that meeting that scientists had responded favourably to the InterRidge code of conduct at a recent Workshop of the Commission for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Commission), but there was interest in more detailed guidelines given the sensitivity of hydrothermal vents. It was suggested that there was a need for greater publicity and endorsement of such codes.

4) Would taking remedial or disciplinary action against violators be worth considering by InterRidge and its collaborating organizations?

This decision would have to be made by each of the InterRidge collaborating organizations. An organization could adopt the *InterRidge Statement* as a measure in staff performance evaluation. However, as is inherently the case for most codes of conduct, voluntary compliance and lack of penalties for violations leave the door open for unethical behaviour, particularly on the part of researchers who were not involved in the drafting of the code or who do not belong to an organization collaborating with InterRidge, and are therefore uncommitted to the adoption of the code.

The international community through the Census of Marine Life programme and InterRidge are developing open databases with detailed information on all available vent biological samples preserved in laboratories and museums around the globe as a resource to minimize repeat sampling of vent fauna. In addition, many national ridge programs are hosting open-access databases of geological, chemical, and biological hydrothermal vent data (InterRidge 2006). Each collaborating organization can decide whether it is worth spending resources to ensure that its researchers are complying with the code of conduct or run the risk of losing the privilege of accessing these databases. A cost-benefit analysis could help in decision-making on this aspect when data that indicate the value of these databases become available.

73. Although the analysis of the potential effectiveness of the InterRidge Statement only serves as an illustrative case and not a basis for generalizing the potential applicability of codes of conduct in the management and conservation of seabed habitats, the analysis indicates that:

(a) Codes of conduct by themselves might not be significant deterrents of misconduct while doing scientific investigations. However, they provide an essential, documented minimum benchmark of expected behaviour among researchers;

(b) There are costs to be incurred in the maintenance and enhancement of the code of conduct beyond the development of the code. Provision of funding to cover these costs is essential for the code's effectiveness;

(c) There seems to be a positive reaction among the users of codes of conduct and some form of incentive could help in the effective application of the codes. However, there are as of yet no data to prove their effectiveness is not available yet and they are difficult to obtain; and

(d) The imposition of penalties for violators of the code takes the essence out of its voluntary nature although adoption of penalties in combination with the code of conduct might make the code more effective.

3. Permits and Environmental Impact Assessment (EIA)

74. Permits and EIA are among the available management tools under existing global, regional, and national instruments, along with area-based management options, which, because of their variety and potential applicability, are discussed separately in the succeeding section.

75. Permit systems are among the techniques that work on the basis of cooperation, reciprocity, and mutual trust. The implementation of permit systems by States is considered to be effective (Birnie and Boyle 2002). Lessons learned from the successful implementation of this system could inform the development of mechanisms in the management of extractive activities in marine areas beyond national jurisdiction. For example, listing of species, sites, and substances that need regulation is a common conservation technique used in international instruments. There are lists that work in combination with various management tools to function as intended, such as: 1) Convention on Migratory Species endangered species list; and 2) list of areas of international importance (e.g., UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage). Lists are commonly applied in combination with a system of permits, with each Party required to enact the necessary legislation (Birnie and Boyle 2002). Examples of these include: 1) list of endangered and threatened species (e.g., CITES); and 2) list of substances for disposal at sea or lists of specific wastes characterized as hazardous or non hazardous (e.g., MARPOL 73/78, London Convention, and Basel Convention). Permits are authorizations given to conduct a specific activity if it meets an established set of criteria as required by law (Davis 2003).

76. Environmental impact assessment (EIA) is a tool used in a permit system. It is 'a procedure for evaluating the likely impact of a proposed activity on the environment' (1991 Convention on Environmental Impact Assessment in a Transboundary Context, Article 1(vi)). First adopted in the United States in 1970, it has become an important tool in national environmental management, with a large number of nations implementing the practice in various forms (Birnie and Boyle 2002), including: project level EIA, Strategic and Sectoral Environmental Assessments including at the regional level (e.g., EU Directive on Strategic Environmental Assessment), Country Environmental Assessments, and Environmental Audits and Appraisals (MFI-WGE 2003). EIA primarily aims to ensure that environmental and social impacts of certain activities are identified and addressed. The EIA process provides decision-makers and stakeholders with adequate information when deciding whether to authorize an activity (Birnie and Boyle 2002; MFI-WGE 2003).

77. Despite its widespread adoption within national jurisdictions, the usefulness of EIA in promoting biodiversity conservation is just being explored (Mandelik et al 2005). Habitat loss and fragmentation, the major threats to biodiversity, could be possibly addressed by a combination of EIA and strategic environmental assessment (SEA) 27/ but there are no well-developed methods and guidelines in place (Gontier et al. 2006). The conservation and sustainable use of biodiversity could be pursued, in particular,

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27/ Strategic Environmental Assessment (SEA) is *a process to ensure that significant environmental effects arising from policies, plans and programmes are identified, assessed, mitigated, communicated to decision-makers, monitored and that opportunities for public involvement are provided* (SEA Information Service 2007). SEA is used for assessing policies, plans and programs; EIA is used for assessing specific projects.

through SEA where consideration of biodiversity could be placed at higher levels of decision-making (Treweek et al. 2005).

78. In integrated ocean and coastal management, EIA can be a preventive environmental management tool used in decision-making, particularly when there are no coastal water-use plans that stipulate which activities are or are not allowed in certain areas. It could therefore be an important tool that may be used in combination with other management options. Certain international instruments already require environmental assessment before a particular activity may take place in marine areas, including: 1972 London Convention, 1982 UNCLOS, 1991 Antarctic Environment Protocol, 1992 Convention on Biological Diversity, 1994 Agreement relating to Part XI of UNCLOS, 1995 Fish Stocks Agreement, and 2000 International Seabed Authority regulations for exploration and exploitation for polymetallic nodules in the Area (CBD 2005a). EIA is also among the Principles of the Rio Declaration (1992 UN Conference on Environment and Development Annex 1 Principle 17), particularly its emphasis on the involvement of the public in the process (UNCED Annex 1, Principle 10).

79. According to Article 22 of the Convention on Biological Diversity, the Convention does not affect the rights or obligations of any Contracting Party, which are derived from an existing international agreement, including UNCLOS, except in those instances where those rights or obligations would pose a serious threat to biological diversity. Furthermore, Article 22 provides that "Contracting Parties shall implement this Convention with respect to the marine environment consistently with the rights and obligations of States under the law of the sea," as reflected in UNCLOS. 28/ This includes identification and monitoring of processes and activities within and beyond the limits of national jurisdiction in accordance with Article 4(b) of the Convention, as well as environmental impact assessment of proposed projects likely to have significant adverse impacts on biodiversity in accordance with Article 14 of the Convention (CBD 2005a). In its decision VI/7-A, the Conference of the Parties (COP) at its sixth meeting adopted guidelines for incorporating biodiversity-related issues into environmental impact assessment legislation or processes and in strategic impact assessment (CBD 2003). In the same decision, the Conference of the Parties requested the Executive Secretary:

(a) To compile and disseminate, through the clearing-house mechanism and other means of communication, current experiences in environmental impact assessment and strategic environmental assessment procedures that incorporate biodiversity-related issues, as well as experiences of Parties in applying the guidelines; and

(b) In light of this information, to prepare, in collaboration with relevant organizations, in particular the International Association for Impact Assessment (IAIA), proposals for further development and refinement of the guidelines, particularly to incorporate all stages of the environmental impact assessment and strategic environmental assessment processes taking into account the ecosystem approach (particularly principles 4, 7 and 8) and to provide a report of this work to the Subsidiary Body prior to the seventh meeting of the Conference of the Parties (CBD 2003).

80. The Conference of the Parties to the Convention on Biological Diversity, at its eighth meeting in 2006, noted the progress made on decision VI/7-A, including:

(a) Development of a searchable database with case-studies and other submissions from Parties and members of the IAIA (http://www.biodiv.org/programmes/cross-cutting/impact/search.aspx);

(b) Preparation of revised guidelines on biodiversity-inclusive EIA and SEA (UNEP/CBD/COP/8/27/Add.2);

(c) Implementation of capacity-building activities by the IAIA, including participation of project members in the review of biodiversity-inclusive EIA and SEA draft guidelines; and

(d) Preparation of a draft good practice guidance for mining and biodiversity by the International Council on Mining and Metals for use by technical and environmental managers (CBD 2006g).

28/ CBD Article 22. Available. http://www.cbd.int/convention/articles.shtml?a=cbd-22

81. The Voluntary Guidelines on Biodiversity-Inclusive Environmental Impact Assessment describe the stages in the EIA process and provide details on the biodiversity issues, which may have to be addressed at each stage of the process. It also includes an indicative set of criteria for further elaboration by States and an indicative list of ecosystem services (CBD 2006g).

82. The development of a common framework for EIA among relevant bodies for environmental impact assessment of specific activities, such as bioprospecting and deep seabed mining, or for application in specific areas, e.g., in the Area 29/ or in particular regions, has been put forward (CBD 2005a).

4. Area-based management tools, including establishment of marine protected areas

83. Area-based management 30/ is a type of management approach being used in the marine environment that entails spatially dividing the marine environment for a variety of compatible uses and accounting for the many stressors on the ecosystem (GBMF 2007). It accommodates various types of uses while controlling the adverse impacts of those uses on the marine environment and on the ecosystems and resources found therein. There are various types of area-based management in terms of purpose. Area-based regulation can be used to address multiple impacts and to zone various uses, which can provide protection against impacts caused by scientific research, commercial exploitation, and practices with destructive impacts. The removal of stresses through area-based regulation can enhance the resilience of deep seabed ecosystems to cope with potential future threats arising from climate change. Area-based regulation may also be accomplished through the regulation and/or prohibition of detrimental or destructive practices in a vulnerable area, and through the establishment of marine protected areas. Action can be taken voluntarily by several countries, in the framework of a regional treaty, or in the context of a global instrument (2005a).

84. A number of regional seas agreements provide for the creation of area-based management of uses such as nature reserves, marine parks, and protected areas, including: 1940 Convention on Nature Protection and Wild-Life Preservation in the Western Hemisphere; 1968 African Convention on the Conservation of Nature and Natural Resources; 1985 ASEAN Agreement on the Conservation of Nature and Natural Resources; 1986 Convention for the Protection of the Natural Resources and Environment of the South Pacific Region; 1990 Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region; 1991 Antarctic Environment Protocol; 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic; and 1995 Protocol Concerning Mediterranean Specially Protected Areas (SPA Protocol). In December 2006, the UN General Assembly adopted a resolution which takes notes of the efforts of the Caribbean States to further develop their concept of the Caribbean Sea as a special area, 31/ without prejudice to international law (UN GA resolution 61/197, UNGA 2007a). Annex II summarizes the provisions of regional instruments relevant to area-based management of ocean uses.

85. For further information, a comprehensive review of the international legal regime of the high seas and the seabed beyond the limits of national jurisdiction as it relates to the establishment of marine protected areas was undertaken (UNEP/CBD/WG-PA/1/INF/2). MPAs and other types of area-based management of uses including Particularly Sensitive Sea Areas (PSSAs), Special Areas, monitoring and science areas, and marine spatial zones are discussed below.

29/ "Area" means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction (Article 1 of the UNCLOS).

30/ Area-based management approaches simultaneously address interrelated resources and uses of the marine environment and multiple objectives, and integrate stakeholders and management authorities within ecosystem-based boundaries using distinct geographic areas as management units (Davis 2003).

31/ This "special area" is not a MARPOL special area.

1) Marine Protected Areas (MPAs)

86. In its decision VII/5, the Conference of the Parties (COP) to the Convention on Biological Diversity, at its seventh meeting, agreed that MPAs are one of the essential tools and approaches in the conservation and sustainable use of marine and coastal biodiversity. The Conference of the Parties also recognized the need for international cooperation and action to improve conservation and sustainable use of biodiversity in marine areas beyond the limits of national jurisdiction, including the establishment of further MPAs consistent with international law, and based on scientific information, including areas such as seamounts, hydrothermal vents, cold-water corals and other vulnerable ecosystems (CBD 2005a).

87. A protected area is “an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources, managed through legal or other effective means” (UNEP WCMC n.d.). Marine protected areas are defined in various ways. IUCN defines marine protected areas as “any area of inter-tidal or sub-tidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (CBD 2001). Marine and Coastal Protected Areas (MCPAs), as defined by the Ad Hoc Technical Expert Group on Marine and Coastal Protected Areas convened by the Convention on Biological Diversity, refer to a variety of designated areas with varying degrees of protection and management, ranging from areas allowing certain human activities to areas fully protected. IUCN classifies MCPAs based on management objectives of scientific research, wilderness protection, species diversity, environmental services, natural/cultural features, recreation, education, sustainable use, and cultural attributes. As such, IUCN Protected Area Management Categories include strict nature reserve/wilderness area (for scientific research only or for wilderness protection of unmodified area), national parks (for ecosystem protection and recreation), natural monument (for conservation of specific features), habitat/species management area (for conservation through management), protected landscape/seascape (for landscape conservation and recreation), and managed resource protected area (for sustainable use of ecosystems) (CBD 2001).

88. MPAs provide a framework to implement ecosystem and precautionary approaches (CBD 2005a). At the national and sub-national levels, marine protected areas are defined differently depending on the scope and type of area protected and main purpose of protection. MPAs may be designated to enhance the management of marine resources (National Academy of Sciences 2007) or to accommodate multiple uses and degrees of protection. In its decision VII/5, the Conference of the Parties agreed that an effective marine and coastal biodiversity management framework would comprise sustainable management practices over the wider marine and coastal environment, including integrated networks of marine and coastal protected areas consisting of: (i) marine and coastal protected areas, where threats are managed for the purpose of biodiversity conservation and/or sustainable use and where extractive uses may be allowed; and (ii) representative marine and coastal protected areas where extractive uses are excluded, and other significant human pressures are removed or minimized to enable the integrity, structure, and functioning of ecosystems to be maintained or recovered. Scientific reference areas provide an example of the latter category (CBD 2005a).

89. Criteria are needed to identify priority areas for protection, especially those that are of critical importance or are particularly sensitive to disturbance, as well as areas that are representative of the ecosystems under consideration. Many Governments and some regional organizations already have such criteria. Pursuant to recommendation 1/1 of the Ad Hoc Open-ended Working Group on Protected Areas, a Scientific Experts’ Workshop on Criteria for Identifying Ecologically or Biologically Significant Areas beyond National Jurisdiction was held on December 6-8, 2005 in Ottawa, which recommended scientific criteria including: uniqueness or rarity, critical life-history functions/habitats, vulnerability, productivity, biological diversity, naturalness, and representativeness (CBD 2006d). Building upon Ottawa Workshop, the Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection, held from 2 to 4 October 2007 in the Azores, Portugal, developed a consolidated set of scientific criteria for identifying ecologically or biologically significant marine areas in need of protection, in open ocean waters and deep sea habitats, consisting of seven criteria: (i) uniqueness or

rarity; (ii) special importance for life history stages of species; (iii)importance for threatened, endangered or declining species and/or habitats; (iv) vulnerability, fragility, sensitivity or slow recovery; (v) biological productivity; (vi) biological diversity; and (vii) naturalness.

90. The Conference of the Parties at its seventh meeting, in its decision VII/28 paragraph 18, also recommended the establishment and maintenance of "comprehensive, effectively managed, and ecologically representative national and regional systems of protected areas" by 2012. Bio-geographical classification schemes are essential for determining that the systems of protected areas are ecologically representative. Such schemes were reviewed and the results were presented in a report to the eighth meeting of the Conference of the Parties (CBD 2006b). Although the report only included the draft version of the Marine Ecoregions of the World restricted to the coast and shelf areas, it is envisaged that the final version will include pelagic surface waters to 1,000 m. Ecoregions were defined in the report as the smallest-scale units, which represent the "jumping-off point" for field-based conservation planning (CBD 2006b). The report defines marine ecoregions as:

> *…areas of relatively homogeneous species composition that clearly differ in this regard from adjacent systems. This species composition is likely to be determined by the predominance of a small number of ecosystems and/or a distinct suite of oceanographic or topographic features. The dominant bio-geographic forcing agents defining the ecoregions vary from location to location but may include: isolation, upwelling, nutrient inputs, freshwater influx, temperature regimes, ice regimes, exposure, sediments, currents, and bathymetric or coastal complexity* (CBD 2006b).

91. In that report, endemism was not considered a key determinant in ecoregion identification, which may have to be reconsidered in the development of bio-geographical classification systems in open ocean and deep seabed areas beyond the limits of national jurisdiction because of the high significance of endemism in deep seabed habitats. A Scientific Experts' Workshop on Biogeographic Classification Systems in Open Ocean and Deep Seabed Areas beyond National Jurisdiction was held on 22-24 January 2007 in Mexico City, building on experiences and efforts of existing relevant global and regional management bodies in developing representative classification systems (UNAM et al. 2007).

92. Annex V to the Protocol on Environmental Protection to the Antarctic Treaty (Madrid, 1991) provides for the designation of Antarctic Specially Protected Areas or Antarctic Specially Managed Areas. Such areas can be established in the "Antarctic Treaty Area," which includes areas beyond national jurisdiction. 32/ However, no such areas have been proposed for designation beyond areas of national jurisdiction at this time (IUCN 2006).

93. In the Mediterranean, States have established MPAs in areas beyond the limits of national jurisdiction. The Pelagos Sanctuary for Mediterranean Marine Mammals, initially established by a tripartite agreement among France, Italy, and Monaco in 1999, was accepted as a specially protected area of Mediterranean interest in 2001, making its protection binding on all 21 parties to the Barcelona Convention (CIESM 1999; CBD 2005b). Around 53% of its 87,000 km2-area is within international waters, encompassing a variety of underwater habitats, including a continental slope and deep canyons (CBD 2005b). The Pelagos Sanctuary is located in the Ligurian basin ("Ligurian Sea") of the Mediterranean Sea, which counts as one of the areas with highest concentrations of whales and dolphins in the Mediterranean, with as many as eight cetacean species, including the fin whale, occurring there (Tethys Research Institute n.d.). The Ligurian Sea, however, is affected by pollution, heavy vessel traffic, and intense fishing activities, posing significant threats to cetaceans, in addition to ship-strikes. Although currently there is no evidence of change in terms of management, the agreement represents an important step toward the effective protection of animals and marine mammals living in the area (WDCS 2007).

94. The OSPAR Commission has issued its recommendation to establish the OSPAR Network of MPAs and to evaluate by 2010 an ecologically coherent network of well-managed MPAs (OSPAR 2003).

32/ Madrid Protocol (Protocol on Environmental Protection to the Antarctic Treaty), Annex V, 4 October 1991, 30 ILM 1461 (1991). The Protocol entered into force in January 1998 following ratification by Japan.

The recommendation includes guidelines for the identification and selection of MPAs in the OSPAR Maritime Area (OSPAR 2003). In a recent meeting of the Intersessional Correspondence Group on Marine Protected Areas (ICG-MPA) of the OSPAR Convention, the OSPAR Commission decided to take forward as a test case a proposal to nominate the Rainbow Hydrothermal Vent Field, located beyond the limits of national jurisdiction, to the OSPAR network (CBD 2005b). Other candidate sites to the OSPAR network include: Josefine Bank (WWF 2006d), Rockall Bank (WWF 2006d), and Mid Atlantic Ridge/Charlie Gibbs Fracture Zone (WWF 2006b).

95. States parties to regional seas agreements that encompass areas beyond the limits of national jurisdiction can agree to establish high seas marine protected areas among themselves and, depending on the threat to the area, can also propose the areas for protection to the relevant measures provided by RFMO and the IMO, as necessary. If the proposed area is located in the Area, 33/ the International Seabed Authority (ISA) is the relevant organization. Seeking cooperation from parties to the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the Convention on Biological Diversity can also be useful due to their broad focus and global membership. Additionally, States can agree to establish a new agreement to cooperatively manage a specific area through regulating their own nationals, flagging vessels, and agreeing to mutual enforcement procedures (Gjerde and Kelleher 2006).

96. In response to the increased threats to cold-water coral and sponge reefs, several States, including Canada, Norway, the UK, and the U.S., have closed cold-water coral habitats in their waters to bottom fishing (Gianni 2004). The UNGA has also addressed the issue of bottom fisheries in areas beyond the limits of national jurisdiction in its resolution 61/105, which calls upon States to take action immediately, and consistent with the precautionary approach and ecosystem approaches, to sustainably manage fish stocks and protect vulnerable marine ecosystems from destructive fishing practices, including seamounts, hydrothermal vents, and cold water corals. Paragraphs 66 to 69 of UNGA resolution 59/25, which address the impacts of fishing practices on such vulnerable marine ecosystems, was also reaffirmed in resolution 61/105, as was the urgent need for additional actions to address destructive fishing practices (UNGA 2007b).

97. Resolution 61/105 further calls upon regional fisheries management organizations or arrangements to take measures to regulate bottom fisheries by 31 December 2008, including: a) assessing whether bottom fishing activities would have significant adverse impacts on vulnerable marine ecosystems and managing these activities to prevent such impacts, or not authorizing the activities to proceed; (b) identifying vulnerable marine ecosystems and determining whether bottom fishing activities would cause significant adverse impacts to such ecosystems and the long-term sustainability of deep sea fish stocks, by improving scientific research and data collection; (c) closing bottom fishing areas where vulnerable marine ecosystems are known or likely to occur based on the best scientific evidence available, until conservation and management measures are established, to prevent significant adverse impacts on vulnerable marine ecosystems. (UNGA 2007b).

98. In addition, States participating in negotiations to establish a new regional fisheries management organization or arrangement are to adopt and implement interim measures consistent with the above by 31 December 2007. Furthermore, flag States are to adopt measures consistent with the above (i.e. in accordance with paragraph 83 of resolution 61/105) or cease to authorize vessels flying their flag to conduct bottom fisheries in areas beyond the limits of national jurisdiction where there are no relevant regional fisheries management organizations or arrangements34. States are also to provide information to the FAO on vessels flying their flag that are authorized to conduct bottom fisheries in areas beyond the limits of national jurisdiction, as well as information on the measures adopted to regulate bottom fishing.

99. FAO's work on managing deep sea fisheries, such as the expert consultation held in Bangkok, 21 to 23 November 2006, has proven beneficial. The UNGA has invited the FAO's Committee on Fisheries

33/ Refer definition in the footnote 29.

34/ Paragraph 86. UNGA Resolution 61/105 (UNGA 2007b).

to enhance data collection and dissemination, promote information exchange and increased knowledge on deep sea fishing activities, develop standards and criteria for use in identifying vulnerable marine ecosystems and the impacts of fishing on such ecosystems, establish standards for deep sea fisheries management (such as through an international plan of action), and create a global database of information on vulnerable marine ecosystems in areas beyond the limits of national jurisdiction. 35/

100. 100. States can also mutually agree to regulate their nationals' activities to protect a specific area. An example is the agreement negotiated by Canada, France, the United Kingdom, and the United States to preserve and honour the wreck of the Titanic. It obliges the Parties to strictly regulate salvage and other operations that are potentially harmful to the marine environment by their nationals and vessels and to prohibit activities inconsistent with the Agreement in their territory and territorial sea (Gjerde and Kelleher 2006).

101. An example of the practical application of a methodology to identify and designate candidate MPAs on a large spatial scale is provided by the Greenpeace report "Roadmap to Recovery" (Roberts et al. 2006). To achieve the aims set for creating a global network, many different kinds of biological, physical and oceanographic data were brought together. To ensure that the proposed network was representative, data on the distribution of different biogeographic areas, depth zones, seabed sediment types and ocean trenches were also used. Particular attention was paid to highly sensitive deepwater habitats by using maps of seamount distribution and bathymetry to identify places vulnerable to harm by bottom fishing.

2) Particularly Sensitive Sea Areas and Special Areas

102. IMO can apply two types of spatial protection designations: Special Areas (related to pollution and discharges) through the MARPOL Convention; and Particularly Sensitive Sea Areas (PSSAs), developed through IMO Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas (IMO Res.A.982 (24)). The criteria are not mutually exclusive, and the two designations can overlap.

103. Particularly Sensitive Sea Areas (PSSAs), designated through the IMO, may be established where shipping poses a serious threat to the marine environment. A Particularly Sensitive Sea Area is one that needs special protection through the adoption of associated protective measures by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities.

104. Guidelines, including criteria, on designating a PSSA are contained in resolution A.982(24) Revised guidelines for the identification and designation of Particularly Sensitive Sea Areas (PSSAs). The criteria include: ecological criteria, such as unique or rare ecosystem, diversity of the ecosystem, or vulnerability to degradation by natural events or human activities; social, cultural and economic criteria, such as significance of the area for recreation or tourism; and scientific and educational criteria, such as biological research or historical value (IMO 2005). Areas currently designated as PSSAs are in areas within national jurisdiction.

105. The concept of PSSAs and the associated protective measures that apply in the PSSA may also be relevant for the development of MPAs and reserves in areas beyond the limits of national jurisdiction (Raaymakers 2003). The IMO Guidelines for PSSAs explicitly state: 'The criteria relate to PSSAs within and beyond the limits of the territorial sea. They can be used by IMO to designate PSSAs beyond the territorial sea with a view to the adoption of international protective measures regarding pollution and other damage caused by ships' (IMO 2005). The view has therefore been expressed that the IMO regime provides an existing, globally accepted, international mechanism for the establishment of special protective measures in certain areas, which could be used in developments regarding management

35/ Paragraphs 89 to 90. UNGA Resolution 61/105 (UNGA 2007b).

arrangements for areas beyond the limits of national jurisdiction, where shipping is an issue (Raaymakers 2003).

106. In addition, MARPOL 73/78 defines certain sea areas as "special areas" where, for technical reasons relating to their oceanographic and ecological condition and to their sea traffic, the adoption of special mandatory methods for the prevention of sea pollution is required. Under the Convention, these special areas are provided with a higher level of protection than other areas of the sea. MARPOL 73/78 also establishes certain sulphur oxide Emission Control Areas with more stringent controls on sulphur emissions (IMO 2005). There are a number of areas that have been designated by IMO as MARPOL Special Areas under one or more of the MARPOL Annexes. However, not all designated special areas have taken effect due to lack of adequate reception facilities (IMO 2002). MARPOL Special Areas that include the high seas are as follows: Annex I (no oily discharges): the Mediterranean Sea and the Antarctic area (south of 60S); Annex II (no noxious liquid discharges): Antarctic area (south of 60S); and annex V (no garbage discharge): Antarctic (south of 60S).

3) Monitoring and Science Areas

107. Area-based management tools may also be established for the purpose of long-term research. These areas are called “Stable Reference Areas (SRA)” or “Monitoring Areas” (Thiel 2001). There are two kinds of SRAs: “Preservational Reference Area” and “Impact Reference Area” (Thiel 2001) also called “Preservational Reference Zones” and “Impact Reference Zones,” respectively, as provided for in the Regulations for Prospecting and Exploration for Polymetallic Nodules in the Area (ISA 2000; ISA 2005). “Impact reference zones” are areas to be used for assessing the effect of activities in the Area on the marine environment and which are representative of the environmental characteristics of the Area. “Preservation reference zones” are areas where no mining occurs, to ensure representative and stable biota of the seabed remain, in order to assess any changes in the flora and fauna of the marine environment (ISA 2000). The rules and regulations on polymetallic nodules require contractors applying for exploration rights to include “proposals for areas to be set aside and used exclusively as impact references zones and preservation reference zones” in programs for monitoring and evaluating impacts of deep seabed mining on the marine environment (ISA 2000). Consideration and adoption of new regulations for prospecting and exploration for polymetallic sulphides and cobalt-rich crusts are under deliberation (ISA 2005).

4) Marine Spatial Planning

108. Marine Spatial Planning (MSP) involves analyzing and allocating parts of three-dimensional marine spaces to specific uses, to achieve ecological, economic, and social objectives that are usually specified through the political process (UNESCO 2006b). The idea was stimulated by international and national interests in developing MPAs (e.g., Great Barrier Reef Marine Park in Australia). Recent attention has been placed on managing the multiple uses of marine space, particularly in areas where use conflicts are already present (e.g., North Sea). The People’s Republic of China has national legislation that requires zoning of functional uses in its territorial sea; other countries (Belgium, Germany, the Netherlands, and United Kingdom) and regions (Northeast Atlantic region through OSPAR and the EU) are exploring the use of marine spatial planning, along with several major NGOs (Belgian Science Policy 2005; Crowder et al. 2006; UNESCO 2006; Agardy 2007). Since marine spatial planning and ocean zoning are area-based, they can be carried out at a marine ecosystem level (UNESCO 2006).

109. Marine Spatial Planning (MSP) was the subject of an international workshop by UNESCO from 8 to 10 November 2006 in Paris, France (UNESCO 2006). The workshop’s conclusions are as follows: 1) need for legal basis; 2) need for the use of ecosystem features as a planning template; 3) need for the use of multi-disciplinary human dimension; 4) need to apply MSP in combination with other sea use management tools; 5) need for early and continuing engagement of stakeholders; 6) MSPs could have varying levels of knowledge and legal status; 7) driving forces for MSPs should include biodiversity, security, sustainable management, and precautionary approach; 8) political will to convert plans to action is essential; 9) monitoring and evaluation are critical elements of the MSP process; 10) MSP and

implementation should be closely linked with integrated coastal management (ICM) activities; and 11) MSP is a learning, adaptive process (UNESCO 2006). Considering that MSP or zoning is one of the tools of ICM, it is no wonder that the conclusions of the workshop reflected the learning previously established in ICM meetings and conferences. The lessons from MSP and ICM implementation are a rich source of learning that could be adapted in area-based management in areas beyond the limits of national jurisdiction.

5) Applicability of area-based management to the management and conservation of seabed habitats

110. Lessons learned in the application of area-based management, particularly MPAs as applied to marine areas under national jurisdiction, could be used in the development of MPAs in areas beyond the limits of national jurisdiction (James 2006; IMPAC1a 2006; IMPAC1b 2006). A few key lessons drawn from MPA experience within national jurisdiction may be applicable to the establishment of MPAs in areas beyond the limits of national jurisdiction, which are offered for consideration below. More lessons learned are available from reports and guidance put together based on national experience (see Salm et al. 2000; Crawford et al. 2000; Belfiore et al. 2004; IMPAC1 2006a; IMPAC2 2006b, to name a few), from which the following are drawn:

1) While a general framework for establishing MPAs has emerged over the years, there could be much adaptation and variation within the basic framework, depending on a range of factors that include, but are not limited to: habitat and resources to be protected, including the value of these resources; existing and potential uses in the candidate area and corresponding adverse impacts; institutions and stakeholders that will be involved; current legislative framework covering the area; and financial and other resources available for the implementation of the MPA. The design and implementation of an MPA model that can adequately address the issues in a candidate area are critical for its success. For an MPA in areas beyond the limits of national jurisdiction, its design would be largely contingent on the deep seabed habitat to be protected, and the current level of knowledge about the habitat, including existing and emerging uses and threats.
2) MPAs need long-term commitment of resources from institutions involved in order to make it work. Intervening institutions need to stay engaged within an undetermined timeframe in order to ascertain that the management activities in place would be effective. Immediate, intermediate, and long-term objectives and indicators for success also need to be established, especially for deep seabed habitats where living resources tend to take long to recover, such as the long-lived species inhabiting seamounts. Indications of MPA effectiveness in such cases may take some time before they become evident.
3) Supportive and strong leadership within intervening institutions is an important element that could influence the successful establishment of an MPA in a candidate area. Additionally, adequate participation in the planning process of all major stakeholders in the candidate area is essential. Capacity building activities are also necessary to keep MPA staff and other contributors knowledgeable and well-trained, especially as issues addressed by the MPA evolve and as MPA techniques become more sophisticated.
4) A clear legal mandate that institutionalizes the MPA not only provides the backbone upon which mechanisms for its implementation are based but also serves as the basis for accessing funds and other resources needed for implementation. Moreover, it is important to embed the establishment of MPAs within a broader framework of governance in order to increase the likelihood of their sustainability.
5) Strengthening linkages to support institutions from all sectors involved, especially the science sector, contributes to sustainability and long-term success. Adaptive mechanisms informed by regular monitoring and assessment of progress are also necessary. This is particularly important when MPAs start to address global emerging issues, such as climate change impacts, which need substantial scientific input in the development of mitigation and adaptation mechanisms. Experience in building resilience into MPA programs in tropical coral reefs that address large-scale emerging threats, especially coral bleaching, could inform the process of incorporating

adaptation mechanisms for climate change impacts in MPAs in areas beyond the limits of national jurisdiction (Salm et al. 2006). A good start is the five-pronged approach that the Nature Conservancy is implementing to help practitioners enhance resilience at different levels of MPA planning and management, which involves, among other activities, conducting research that could provide better science to support decision-making; providing tools for field practitioners in building resilience into their conservation programs; integrating resilience in the design of MPA networks; and providing sustainable financing to a broad constituency of scientists and experts for them to incorporate resiliency in their research or conservation programs (Salm et al 2006).

6) Achieving compliance and enforcement of MPA rules and regulations and adhering to MPA management plans have been the major constraints in the effective implementation of MPAs in areas within national jurisdiction. In areas beyond the limits of national jurisdiction, the main problem would be the enforcement of regulations governing extractive activities, such as fishing, especially if the MPA contains no-take zones. Three inter-related components to achieving compliance and enforcement of fishing regulations in areas beyond the limits of national jurisdiction include: 1) eliminating the economic drivers that make illegal, unregulated and unreported (IUU) fishing attractive; 2) reinforcing the duties of flag states; and 3) strict vessel monitoring, control and enforcement (Schmidt 2005). In addition, FAO is working towards strengthening port State control measures to combat IUU fishing,36/ which is particularly difficult to attain in MPAs beyond the limits of national jurisdiction since MPAs serve as magnets to fishers because of their association with biological productivity and rich fishing grounds. Compliance and enforcement issues in MPAs within national jurisdiction are normally addressed by combining regulatory and non-regulatory mechanisms, especially economic incentives, which might need to be adopted in high seas MPAs in areas beyond the limits of national jurisdiction as well. Achieving compliance and enforcement would also depend on the number of parties that would accede to legal instruments that would be adopted to establish MPAs in areas beyond the limits of national jurisdiction.
7) As in the case of MPAs within national jurisdiction, there may be limited control over activities that occur outside MPAs, such as shipping and dumping of waste, which could cause adverse impacts to marine resources and the environment within MPAs. Habitat degradation then becomes indirect and therefore difficult to manage. Shipping-related environmental impacts include operational discharges and emissions, transfer of invasive aquatic species, and dumping of wastes at sea (Raaymakers 2003). These impacts are being brought under control by involving shipping and associated industries in the policy dialogue regarding MPA establishment, management planning, and implementation within the framework of the IMO PSSA (IMO 2002). In this aspect, the involvement of non-State actors such as NGOs and the private sector is deemed important to success.
8) Area-based management tools need to be assessed as to how they achieve the objectives of preventing and mitigating the adverse impacts of human uses of seabed habitats. The World Bank has developed a scorecard to assess progress in achieving management effectiveness goals for MPAs within national jurisdiction (Staub and Hatziolos 2004). The purpose of the scorecard is to help MPA managers and local stakeholders determine their progress and to identify where they are succeeding and where they need to address gaps. The main part of the scorecard is a series of questions grouped into six management stages or elements, such as context, planning, inputs, processes, outputs, and outcomes. Answers are provided for each question, which are ranked based on level of performance; users will have a score for each stage or element in the MPA

36/ At the 27th meeting of FAO's Committee on Fisheries (4-9 March 2007, Rome), 131 countries agreed to the initiation of a process to develop and adopt a legally binding international agreement for port state control measures to combat illegal fishing. A draft version of the agreement, to be based on the voluntary FAO model recommending port State control measures, will be generated during consultations in 2007 and 2008 with a final approval at the next COFI meeting in 2009. A workshop was held in Mauritius (21-22 June 2007) for 13 countries in the Indian Ocean region to discuss how to improve port state controls to deter IUU fishing. Controls include boat background checks, inspector training, vessel blacklisting, trade measures, and vessel monitoring system programs (FAO 2007).

process and a final or total score for the MPA under consideration after completing the assessment. The factors being measured in the scorecard 37/ could be adapted as factors or conditions of preparedness that need to be considered when establishing MPAs in areas beyond the limits of national jurisdiction. In addition to those measures, two inter-related measures of real progress in MPAs would be specifically relevant to the management of threats to deep seabed habitats and in meeting the WSSD 2010 biodiversity targets, which are: (i) effectiveness of coverage (how much and what biodiversity is included within protected areas?); and (ii) effectiveness in achieving conservation objectives (Are protected areas being managed effectively?) (Chape et al. 2005). Nevertheless, as is commonly observed among management options in territorial seas, the challenge remains to be the standardization of monitoring methodologies and the consistent application of these methodologies in countries in order to come up with meaningful information (Chape et al. 2005) whether applied within or outside areas of national jurisdiction.

9) As area-based management of uses are established, particularly marine protected areas, it is important to keep in focus the plans, programmes, and strategies that had been developed for their widespread implementation. One example is the "Ten-year High Seas Marine Protected Area Strategy" formulated to promote the development of a global representative system of marine protected area networks in areas beyond the limits of national jurisdiction during the 5th IUCN World Parks Congress in Durban, South Africa, 8-17 September 2003 (IUCN 2004). The strategy consists of core components, specific tool boxes, and key strategic steps that include, among others: (i) promoting the achievement of the World Summit on Sustainable Development goal of establishing a global system of representative networks of marine protected areas by 2012 that includes marine areas beyond the limits of national jurisdiction, through identification and dedication of financial and human resources to raise awareness, educate, conduct research, and build capacity; (ii) calling on the UN General Assembly to consider an immediate moratorium on deep sea trawling in areas beyond the limits of national jurisdiction with seamounts and cold-water coral reef communities until legally-binding international conservation measures are in place; (iii) utilizing mechanisms and authorities to establish and effectively manage by 2008 at least five scientifically significant and globally representative HSMPAs; (iv) initiating actions to identify marine ecosystems, habitats, areas, processes and biodiversity hotspots for priority attention, and to develop agreed criteria and guidelines for the establishment and enforcement of HSMPAS; and (v) cooperating to develop and promote a global approach, building on the UNCLOS, the Convention on Biological Diversity, the UNFSA, CMS and other relevant agreements to facilitate the creation of a global representative system of MPA networks in areas beyond the limits of national jurisdiction. A periodic review of the implementation status of the strategy and the available resources for its implementation is essential to move forward in the achievement of the MPA 2012 target.

10) Most regional seas agreements explicitly avoid regulating high seas fishing or shipping activities, as these activities are managed by the relevant regional fisheries management organizations (RFMOs) and the International Maritime Organizations (IMO) (Gjerde and Kelleher 2006). To protect a discrete area beyond the limits of national jurisdiction, it would be necessary to build on or coordinate sector-specific agreements, unless the protection relates to the Area 38/ and comes under the ambit of the International Seabed Authority (ISA) (Gjerde and Kelleher 2006). Some of the management practices that RFMOs use are area-based, in the sense that they effectively designate areas in which certain activities are closed, restricted, or more closely regulated than

37/ Includes, among others: legal status; MPA regulations; law enforcement; boundary demarcation; integration of MPA within a broader management plan; resource inventory; stakeholder awareness and concern; MPA objectives; presence of management plan; research program; staff availability; sufficient budget; education and awareness; communication between stakeholders and managers; stakeholder involvement and participation; involvement of indigenous people; staff training; availability of adequate equipment; and monitoring and evaluation (Staub and Hatziolos 2004).

38/ Refer to the definition in footnote 29.

elsewhere within the area of coverage of the RFMO. Variations of these measures include: prohibition of directed fishing in specifically defined areas; prohibition of specific types of fishing within a defined area and for a specific time period; and prohibition of all fishing within a defined area, and for a specific time period (Breide and Saunders 2005). In order to implement MPAs using existing bodies, the broadening of several RFMO mandates would be necessary in order to take an ecosystem approach to fisheries management, including the establishment of MPAs for conservation reasons. In areas where none currently exist, the establishment of RFMOs and/or regional seas organisations would be required. Where RFMOs and regional seas organisations already currently exist (e.g., in the Northeast Atlantic, where OSPAR and the North East Atlantic Fisheries Commission co-exist), better cooperation and coordinated action regarding the establishment of MPAs for the protection of biodiversity amongst such bodies is required, both within and beyond areas of national jurisdiction.

5. Ecosystem-based and integrated management approaches

111. Ecosystem-based approaches, and other terminologies that refer to "a comprehensive, science-based approach to the conservation and management of natural resources" (Wang 2004 as quoted in UNGA 2006a), have been adopted by international instruments to achieve the sustainable development of oceans and seas and their resources (UNGA 2006a). The 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), the 1982 UNCLOS, the 1992 United Nations Conference on Environment and Development (UNCED), the 1995 United Nations Fish Stocks Agreement, and the 1992 Convention on Biological Diversity are the key instruments that elaborate the use of the concept on ecosystem-based approach at the regional and global policy level.

112. Indeed, the designation of representative marine protected areas/marine reserves is entirely consistent with a precautionary approach in ecosystem management of human activities in the marine environment. Marine reserves allow for uncertainties and unknowns in knowledge and understanding of the ecosystem under management by setting aside whole portions free from human disturbance. Such areas, therefore, can be designated either as refugia or as reference areas. Hence, they provide a de facto baseline against which the impact of activities and onward management strategies can be gauged both within and outside the reserves.

113. In decision VII/11, paragraph 12, the Conference of the Parties requested the Executive Secretary, in collaboration with Parties and relevant international and regional organizations, to assess the implementation of the ecosystem approach, in the light of experiences gained, for the consideration of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) prior to the ninth meeting of the Conference of the Parties. In the report of its 12th meeting, the SBSTTA, in its consideration of the in-depth review of the application of the ecosystem approach, based on background documentation available, expert inputs and scientific dialogue, has reported a range of viewpoints, *inter alia*:

(a) The ecosystem approach remains a useful normative framework for bringing together social, economic, cultural and environmental values. The needs are to translate this normative framework into methods for further application, which are tailored to the needs of specific users;

(b) Global assessments suggest that the ecosystem approach is not being applied systematically to reduce the rate of biodiversity loss, but there are many examples of successful application at the regional, national and local scales which should be widely promoted and communicated. Most of these examples can be considered as positive outcomes for both biodiversity and human well-being; and

(c) There is experience with application, in particular at the local level, but the ecosystem approach needs to be applied much more broadly across all levels. The need now is to enhance access and awareness with the transmission of straight forward messages using practical tools (CBD 2007).

114. In December 2006, as a result of the work of the seventh UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea, which focused its discussions on "ecosystem approaches and

oceans", the General Assembly adopted resolution 61/222, which invited States to consider the agreed consensual elements relating to ecosystem approaches and oceans, as suggested by the Consultative Process, in particular the proposed elements of an ecosystem approach, means to achieve implementation of an ecosystem approach and requirements for improved application of an ecosystem approach, as reflected in the report of the meeting (A/61/156). The discussions during the Consultative Process demonstrated a significant convergence of views among delegations on many aspects of ecosystem approaches and oceans. Considerable importance was generally attached to an ecosystem-based approach to oceans management, and its essential role for the sustainable development of the oceans was underlined. It was acknowledged that while there was no internationally agreed single definition of an ecosystem approach, no such definition was necessary for its implementation, as the concept was well-known and had already been widely accepted and applied. It was recognized that there was no single way to implement an ecosystem approach and that flexibility was required depending on regional, subregional, national or local circumstances. It was thus important that each State formulate its own approach and gradually move towards implementation. The elements that were agreed by the Consultative Process do not define an ecosystem approach, but rather identify several common elements of ecosystem approaches. They also identify the actions needed to implement an ecosystem approach and those required to improve its application (UNGA 2007c).

115. It is important to gain as much information as possible on the ecology of deep seabed habitats in order to have a targeted policy development process but immediate action is nevertheless vital. Projects that strengthen the link between science and policy help fill the knowledge gaps in a more targeted way, e.g., the Hotspot Ecosystems Research at the Margin of European Seas (HERMES), which could contribute information on the natural drivers controlling ocean margin ecosystems, topographic maps, mapping of ecosystem and habitat occurrence, description of habitat and ecosystems, understanding biodiversity and ecosystem functions, forecasting changes in ecosystems, inventories of deep-sea habitats, identification of priority ecosystems in need of protection, strategies for the sustainable use of marine resources, methods and baselines for monitoring, and technology advancement (HERMES 2006).

116. In the case of hydrothermal vents, for example, information is needed on how specifically human uses affect hydrothermal vent structure, functions, and properties (figure 2). It is important to emphasize that ecosystem-based management aims to maintain the integrity of the ecosystem not only for its value in providing human needs and wants, but also for its intrinsic value. Although research activities and/or bioprospecting currently represents the major threat to hydrothermal vents, it is also important to study the potential impacts of potential uses such as seabed mining and development of hydrogen fuel as well as of global climate change. An array of ecological indicators has to be monitored in order to assess the effectiveness of management strategies in addressing the objectives of maintaining biodiversity, species distribution and abundance, primary production and reproduction, trophic interactions, mortalities below thresholds, species health, water and sediment quality, and habitat quality (UNESCO 2006a).

117. Ecosystem-based management (EBM) tools available include software or other highly documented methods that can help implement ecosystem-based management by: (i) providing models of ecosystems or key ecosystem processes; (ii) generating scenarios illustrating the consequences of different management decisions on natural resources and the economy; and (iii) facilitating stakeholder involvement in planning processes (EBM Tools Network 2006).

118. Tools for EBM can perform such functions as: (i) data collection and management; (ii) data processing; (iii) conceptual modeling; (iv) modelling and analysis (e.g., watershed models, marine ecosystem models, dispersal models, habitat models, socioeconomic models, and model development); (v) scenario visualization; (vi) decision support (e.g., coastal zone management, fisheries management, conservation and restoration site selection, land-use planning, and hazard assessment and resilience planning); (vii) project management; (viii) stakeholder communication and engagement; and (ix) monitoring and assessment (EBM Tools Network 2006).

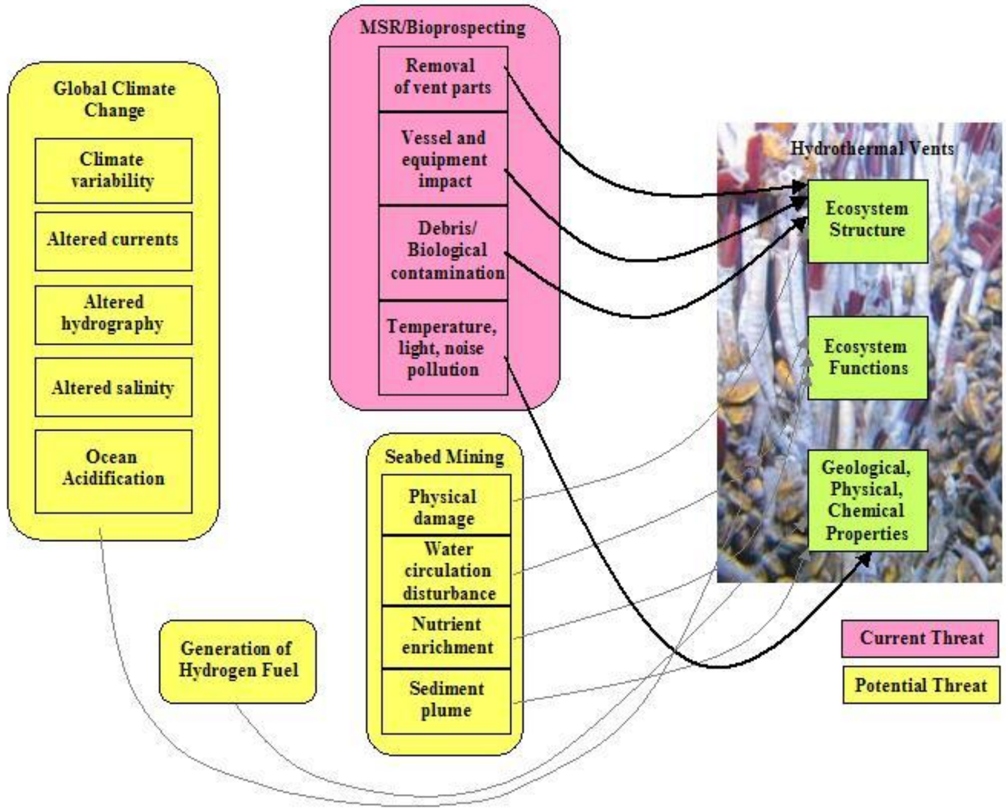

Figure 2. Impacts of human uses on specific components of an ecosystem such as the hydrothermal vent 39

119. The application of the EBM approach in MPAs beyond the limits of national jurisdiction could be facilitated by the development of programme logic models patterned after the generalized programme logic models for MPAs within national jurisdiction. Figure 3 provides an example of a programme logic model that takes into consideration the basic themes of EBM, namely that: (i) humans depend on ecosystem services and thus management should maintain ecosystems in a way that ultimately sustains humans; (ii) supporting ecosystem functions and processes should be a priority of EBM; (iii) EBM requires a long-term focus; and (iv) adaptive management should be applied in view of the dynamic and unpredictable nature of ecosystems (de Mooy 2007).

120. Management decisions may have to be taken under sub-optimal levels of information using the precautionary approach as illustrated in the use of buffer reference points by the Northwest Atlantic Fisheries Organization (NAFO) in fisheries management: the more uncertain the stock assessments are, the greater the buffer zones (Henriksen et al. 2006). The reference points are to be used when it is impossible to undertake analyses of the probability of exceeding the levels below which stock productivity is likely to be seriously impaired (Henriksen et al. 2006). In MPAs, this practice would translate simply into setting aside more expansive buffer zones where certain activities are allowed but kept at a sustainable level, or more pro-actively, into resilience-building techniques (Salm et al. 2006).

121. The integrated coastal and ocean management approach, which involves the "continuous and dynamic process by which decisions are made for the sustainable use, development, and protection of coastal and marine resources" (Cicin-Sain and Knecht 1998), is already widely used in the management of marine and coastal areas (UNGA 2006c). Integrated management approaches recognize the importance of protecting the ecosystem while reconciling conflicting uses of coastal and marine resources. Economic

39/ Colour versions of this map are available electronically at www.cbd.int.

incentives are an important component of integrated management approaches. For example, economic approaches such as contingent valuation are commonly used in convincing decision-makers to account for the ecological as well as material benefits from ecosystems and resources. Integrated ocean and coastal management approaches are commonly applied in marine protected areas, and are among the approaches prescribed in the Ten-Year High Seas Marine Protected Area Strategy (IUCN 2004).

122. Integrated management generally does not replace sectoral management but supplements it (Cicin-Sain and Knecht 1998). Integrated management requires strong sectoral management with an overall, rather than a fragmentary, perspective. Important initiatives in fisheries and shipping emphasize this point. Given the interconnectedness of oceans and the transboundary and global nature of international shipping, effective protection of high seas biodiversity including potentially through spatially defined marine protected areas and reserves, requires integrated, holistic management of the entire ocean system that should consider multiple uses, including shipping, as an integral part of such a system. Accordingly, the IMO regime provides an existing, globally accepted, international mechanism for the establishment of special protective measures in certain areas, which should be used in any development of high seas biodiversity governance arrangements, where shipping is an issue in part or in whole. The work by a Chatham House Panel, with government support, developed a comprehensive suite of recommended best practices for regional fisheries management organizations (RFMOs), which, among other objectives, addresses the challenge of implementing ecosystem-based management approaches to fisheries (Lodge et al 2007).

123. Equally important are cross-cutting approaches, common approaches drawn from various disciplines that could be adopted in devising practical solutions to complex issues in integrated ocean and coastal management, including planning, public education, capacity building, and research. For example, public education based on the outcomes of scientific investigation of the nature of the marine environment and the ecosystems found therein could influence the transformation of unsympathetic stakeholders into cooperative advocates of improved governance of marine areas beyond the limits of national jurisdiction seas. Without public appreciation of the remarkable organisms and ecosystems in areas beyond the limits of national jurisdiction, there would never be an engaged and empowered constituency supportive of its integrated management.

124. The capacity and expertise of government agencies from developing nations need to be built up to ensure that their interests can be adequately represented in international policy-making, and in all other aspects of the management process. Considering that capacity building for the sustainable management of coastal areas and EEZs of coastal nations is currently prioritized over capacity building in other marine resource areas, it may take some time before attention is given to building the capacity of developing countries regarding the management of marine areas beyond the limits of national jurisdiction, however justified by an emerging awareness of the impacts of some activities to deep seabed habitats (Leary 2006).

125. Research should continue to generate the threads of information that could be woven into the deep seabed panorama, for the public to understand and appreciate the wonders that lie beneath the seas. In this regard, noteworthy is the statements made by delegations to the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction, held from 13-17 February 2006, emphasizing that "it [is] essential to build a stronger scientific basis on marine biological diversity beyond areas of national jurisdiction in order to facilitate the adoption and implementation of improved sustainable management and conservation measures of those marine resources" (UNGA 2006b).

VI. CONCLUSIONS

126. Given the preceding assessment, the following bottom-line points are offered for consideration in the management of the impacts of some activities on selected seabed habitats:

(a) The selected deep seabed habitats addressed in this note are important not only for their potential utilizable genetic resources but also in keeping the ecological functions and integrity of the marine environment. Information gathered on these habitats should be disseminated widely across all boundaries to all sectors and at all levels in order to intensify the understanding and motivation for their conservation and effective management;

(b) Destructive and IUU fishing practices can cause significant impacts to deep seabed habitats and their resources. In addition, other threats are emerging from research activities and bioprospecting with adverse impacts, deep-sea adventure tourism, marine debris, ship-source pollution, illegal dumping and the legacy of historical dumping, seabed minerals development, oil and gas and geothermal energy exploration, light and noise pollution, and climate change, all of which need to be addressed using integrated, precautionary, and ecosystem management approaches;

(c) The existing global and regional legal instruments that offer a wide array of management tools, though mostly applied in marine areas under national jurisdiction, provide a wealth of potential scientific and technical options that could be applied in areas beyond the limits of national jurisdiction. The potential applicability of these options could be evaluated using a variety of tools, such as feasibility analysis, cost-benefit analysis, risk analysis, and replicability analysis. The effective application of a set of options that are currently in use, such as those adopted by RFMOs for fisheries and by IMO for shipping, is yet to be assessed. Conservation techniques need to be carefully studied and reconciled for effective use in areas beyond the limits of national jurisdiction or adopted separately by specific sectors or by specific States as appropriate;

(d) A number of management options are potentially applicable in addressing the threats to deep seabed habitats. These include codes of conduct, permits and environmental impact assessment, area-based management, and ecosystem-based management. The application and feasibility of these options in marine areas beyond the limits of national jurisdiction where these selected deep seabed habitats are located, however, needs to be measured, in accordance with the existing legal framework, in order to assess whether and how they could be more widely adopted across sectors and regions. Furthermore, the usefulness of lessons learned in the application of these options in other maritime zones such as territorial seas and EEZs should not be underestimated;

(e) A common evaluation framework and standards/criteria for each management option need to be developed to enable the systematic assessment of their effectiveness across areas and regions in areas beyond the limits of national jurisdiction;

(f) Stakeholders need to start working together in areas beyond the limits of national jurisdiction using their respective comparative advantages, by enhancing the use of all existing tools and techniques in place and adopting potentially useful ones, and in designing and promoting new ways by which these tools could work together in addressing the threats to the various components of deep seabed ecosystems such as through the use of appropriate coordinating mechanisms; and

(g) It is important to align any ongoing work by Governments, non-governmental organizations, and other organizations in the establishment of appropriate management options for areas beyond the limits of national jurisdiction with ongoing the UNGA and other intergovernmental processes.

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Annex I

KEY MANAGEMENT TOOLS AND APPROACHES AND EXAMPLES OF INTERNATIONAL/REGIONAL ENVIRONMENTAL INSTRUMENTS, WHICH PROVIDE FOR THEIR USE 40/

Management tools and approaches	International/Regional Legal Instrument
1. Listing of endangered and threatened species	- 1968 African Convention on the Conservation of Nature and Natural Resources - 1973 Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) - 1979 Convention on the Conservation of Migratory Species of Wild animals (Bonn) - 1979 Convention on Conservation of European Wildlife and Natural Habitats (Berne) - 1992 Convention on Biological Diversity (CBD)
2. Listing of areas of international importance	- 1971 Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar) - 1972 UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage
3. Listing of substances for disposal at sea, and of specific wastes characterized as hazardous or nonhazardous	- 1972 Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) - 1973 International Convention for the Prevention of Pollution from Ships, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) - 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal - 1996 Protocol to the London Convention
4. Permit systems	- CITES - CBD - 1946 International Convention for the Regulation of Whaling
5. Protection of biodiversity and habitats	- 1940 Convention on Nature Protection and Wild-Life Preservation in the Western Hemisphere - 1957 Interim Convention on Conservation of North Pacific Fur Seals - 1959 North-East Atlantic Fisheries Convention - 1955 North-West Atlantic Fisheries Convention Act - 1968 African Convention - 1971 Ramsar Convention - 1979 Bonn Convention - 1979 Berne Convention - 1982 UNCLOS - MARPOL 73/78 - 1969 International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION Convention) and the 1973 Protocol Relating to the Intervention on the High Seas in Cases of Pollution by Substances Other than Oil - 1990 International Convention on Oil Pollution Preparedness,

40/ Data source: Birnie and Boyle (2002); Full text of international agreements.

Management tools and approaches	International/Regional Legal Instrument
	Response and Cooperation (OPRC 90) and the 2000 Protocol on Preparedness, Response and Cooperation to Pollution Incidents by Hazardous and Noxious Substances (HNS Protocol) - CBD - 2007 International Convention on the Removal of Wrecks
6. Creation of nature reserves, marine parks, and protected areas and other area based management tools	- 1940 Western Hemisphere Convention - 1968 African Convention - UNEP Protocols on Specially Protected Areas to Mediterranean and Caribbean Regional Seas Conventions - 1985 ASEAN Agreement on the Conservation of Nature and Natural Resources (Kuala Lumpur) - 1986 Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (Noumea) - 1991 Antarctic Environment Protocol - 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic - CBD - IMO Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas (IMO Res.A.982 (24)
7. Provision of technical and financial assistance	- CBD - World Heritage Convention - Ramsar Convention - Global Environment Facility - 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND) - 1973 International Convention for the Protection of Pollution from Ships, as modified by the Protocol of 1978 - 1982 UNCLOS - 1995 Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (FSA) - Protocol to 1985 Convention for the Protection of the Ozone Layer (Vienna) - 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal - 1993 Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (FAO Compliance Agreement) - 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments
8. Joint inspection of enforcement schemes	- 1946 Whaling Convention - 1974 Convention on Safety of Life at Sea (SOLAS) - 1993 FAO Compliance Agreement - 1995 FSA
9. Exchange of scientific data and other	- 1982 United Nations Convention on the Law of the Sea - 1995 FSA

Management tools and approaches	International/Regional Legal Instrument
information	
10.Environmental Impact Assessment	- CBD - 1972 London Convention - 1982 United Nations Convention on the Law of the Sea - 1991 Antarctic Environment Protocol - 1994 Agreement relating to Part XI of UNCLOS - 1995 FSA - 2000 ISA regulations for exploration and exploitation for polymetallic nodules in the Area
11. Cooperative agreements or arrangements of mutual assistance on a global, regional, subregional or bilateral basis	- 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal - 1993 FAO Compliance Agreement - 1995 FSA - 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage - 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments
12. Use of amendable regulatory scheme	- 1946 International Convention for the Regulation of Whaling - 1973 International Convention for the Protection of Pollution from Ships, as modified by the Protocol of 1978 (MARPOL 73/78)
13. Joint scientific and technical research	- 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments

Annex II

PROVISIONS FOR THE ESTABLISHMENT OF NATURE RESERVES, MARINE PARKS, AND PROTECTED AREAS IN REGIONAL ENVIRONMENTAL AGREEMENTS

Regional Environmental Agreement	Provision
1940 Convention on Nature Protection and Wild-Life Preservation in the Western Hemisphere	- Contracting Parties to establish in their territories national parks, national reserves, nature monuments, and strict wilderness reserves (Article II)
1968 African Convention on the Conservation of Nature and Natural Resources	- Contracting States to maintain and extend within their territory existing conservation areas and establish additional ones to: i) protect ecosystems that are most representative of, particularly those that are in any respect peculiar to, their territories; and ii) ensure the conservation of all species, particularly those listed or which may be listed in the annex to this Convention (Article 10) - Contracting States to establish around the borders of conservation areas, zones within which competent authorities shall control activities detrimental to the protected natural resources (Article 10). - "Conservation area" means any protected natural resource area, whether it be a strictly natural reserve, a national park, or a special reserve (Article 3)
1985 ASEAN Agreement on the Conservation of Nature and Natural Resources (Kuala Lumpur)	- Contracting Parties to create and maintain protected areas, including national parks and reserves, in order to: (a) conserve natural, terrestrial, freshwater and coastal or marine habitats; (b) ensure sustainable use of harvested species; (c) protect endangered species; (d) conserve endemic species; and (e) take all measures in their power to prevent the extinction of any species or sub-species (Articles 3 and 13). - Excluded Uses: Activities that are inconsistent with protected areas' objectives (Article 13).
1986 Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (Noumea)	- Parties to establish protected areas in the South Pacific Region (the "Convention Area"), such as parks and reserves, and prohibit or regulate any activity likely to have adverse effects on the species, ecosystems or biological processes those areas are designed to protect (Article14). - Excluded uses: Dumping and storage of radioactive wastes or other radioactive matter in the Convention Area
1990 Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region	- Each Party to establish protected areas in areas of national jurisdiction in order to sustain the natural resources of the Wider Caribbean Region, and to encourage ecologically sound and appropriate use, understanding, and enjoyment of these areas, by conserving, maintaining, and restoring: a) representative types of coastal and marine ecosystems of adequate size to ensure their long-term viability and to maintain biological and genetic diversity; b) habitats and their associated ecosystems critical to the survival and recovery of endangered, threatened, or endemic species of flora or fauna; c) the productivity of ecosystems and

Regional Environmental Agreement	Provision
	natural resources that provide economic or social benefits and upon which the welfare of local inhabitants is dependent; and d) areas of special biological, ecological, educational, scientific, historic, cultural, recreational, archaeological, aesthetic, or economic value, including in particular, areas whose ecological and biological processes are essential to the functioning of the Wider Caribbean ecosystems (Article 4). - Provides: protection measures, planning and management regime for protected areas; cooperation programme and listing of protected areas; establishment of buffer zones; and other guidance for the establishment and implementation of protected areas. - Excluded uses: Dumping and storage of radioactive wastes or other radioactive matter in the Convention Area
1991 Protocol on Environmental Protection to the Antarctic Treaty	- Designates Antarctica as a natural reserve, devoted to peace and science (Article II) - Provides specific measures for the conservation of Antarctic fauna and flora (Annex 2)
1992 Convention for the Protection of the Marine Environment of the North-East Atlantic	Contracting Parties to: - take the necessary measures to protect and conserve the ecosystems and the biological diversity of the maritime area, and to restore, where practicable, marine areas that have been adversely affected; and - cooperate in adopting programmes and measures for those purposes for the control of the human activities (Annex V, Articles 2 and 3)
1995 Protocol Concerning Mediterranean Specially Protected Areas (SPA Protocol)	- Each Party to take measures to: (a) protect, preserve, and manage in a sustainable and environmentally sound way areas of particular natural or cultural value, notably by the establishment of specially protected areas (SPAs); and (b) protect, preserve, and manage threatened or endangered species of flora and fauna. - Objectives of SPAs: (a) representative types of coastal and marine ecosystems of adequate size to ensure their long-term viability and to maintain their biological diversity; (b) habitats that are in danger of disappearing in their natural area of distribution in the Mediterranean or have a reduced natural area of distribution as a consequence of their regression or on account of their intrinsically restricted area; (c) habitats critical to the survival, reproduction, and recovery of endangered, threatened, or endemic species of flora or fauna; and (d) sites of particular importance because of their scientific, aesthetic, cultural, or educational interest. - Provides protection measures; guidance on planning and management; and other provisions relevant to the establishment and management of SPAs.

Annex III

CODES OF CONDUCT CURRENTLY APPLIED IN THE MANAGEMENT OF THREATS TO SEABED HABITATS

1. FAO Code of Conduct for Responsible Fisheries 41/

Who initiated the development of the code:

Food and Agriculture Organization of the United Nations

Objectives and scope of the code:

The Code seeks to lay down a comprehensive set of guidelines and principles, in accordance with the relevant rules of international law, which, *inter alia*, promote responsible fishing and fisheries activities, taking into account all their relevant biological, technological, economic, social, environmental and commercial aspects. [Article 2]

The Code also aims to serve as a reference to help states establish or improve the legal, institutional, and managerial arrangements required for responsible and sustainable fishing. It applies globally to all fisheries, including fisheries within the EEZ and the territorial sea as well as those in areas beyond the limits of national jurisdiction.

Code content and format:

Seven articles lay down the substantive provisions, which deal with a large number of issues. These are summarized in Article 6, which sets out the general principles in 19 paragraphs. Each substantive article is intended to be freestanding. For example, it is possible that the article on aquaculture might in certain contexts be presented by itself, accompanied by its own technical guidelines, if appropriate. This approach is intended to ensure that the Code can be presented in a flexible manner.

The issues dealt with in the Code are as follows:

Fisheries Management. Article 7 contains many important subheadings concerning management objectives, management framework and procedures, data gathering and management advice, the precautionary approach, capacity management measures, implementation, and financial institutions. It stresses the need for fisheries management to be based on effective data.

Fishing Operations. Article 8 contains provisions on the duties of flag States and port States, as well as provisions on harbours, protection of the environment and the abandonment of structures and reefs. Its overall objective is to promote a framework that would encourage the sustainable development and foster protection of the aquatic environment, and the maintenance of biodiversity while making a significant contribution to the safety of fishing operations. Flag States are encouraged to ensure compliance with appropriate safety requirements as well as to promote access to insurance coverage for fishing vessels. Port states are to provide safe and environmentally sound harbours and landing places.

Aquaculture. Article 9 contains provisions on aquaculture development (which includes both aquaculture and culture-based fisheries). It urges States to establish a framework for promoting responsible aquaculture development, including initiating regular oversight and review to ensure minimal adverse impacts and ecological change. States should implement international codes of practice to ensure genetic diversity of the farm stocks and prevent introduction of non-native species.

Coastal Area Management. The Integration of Fisheries into Coastal Management, covered in Article 10,

41/ The information provided on the Code of Conduct for Responsible Fisheries is drawn from the documents posted on the Internet Guide to International Fisheries Law (http://www.oceanlaw.net/texts/faocode.htm), except as otherwise indicated.

contains provisions relating to the institutional framework, policy measures, regional cooperation, and implementation. The Code calls for the promotion of the precautionary approach for coastal area management and stresses the need to: take into account the fragility of coastal ecosystems, consult those involved in the use of resources, value coastal resources, promote public awareness, and exchange information.

Post-harvest Practices and Trade. Article 11 deals with post-harvest practices and trade and has provisions dealing with responsible use of fish, including measures to protect consumer health, responsible international trade, and laws and regulations relating to fish trade.

Fisheries Research. Article 12 deals with fisheries research. It stresses the importance to responsible fisheries of the availability of sound scientific information to serve as a basis for decisions concerning fisheries management.

Intended users:

Governments, in cooperation with their industries and fishing communities, have the responsibility to implement the Code.

Development of the code:

At its 19th Session (March 1991), the Committee on Fisheries (COFI) called for the development of new concepts that would lead to responsible, sustained fisheries. This was in response to increasing concern over rapid and often uncontrolled exploitation and development of fisheries, particularly over unregulated fisheries in areas beyond the limits of national jurisdiction, which in some cases involved straddling and highly migratory fish species, occurring within and outside EEZs. Subsequently, the International Conference on Responsible Fishing, held in 1992 in Cancún (Mexico), further requested FAO to prepare an international Code of Conduct to address these concerns. The outcome of this Conference, particularly the Declaration of Cancun, was an important contribution to the 1992 United Nations Conference on Environment and Development (UNCED), in particular its Agenda 21. Subsequently, the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks was convened, to which FAO provided important technical back-up. In November 1993, the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas was adopted at the 27th Session of the FAO Conference.

Noting these and other important developments in world fisheries, the FAO governing bodies recommended the formulation of a global Code of Conduct for Responsible Fisheries, which would be consistent with these instruments and, in a non-mandatory manner, establish principles and standards applicable to the conservation, management, and development of all fisheries. The Code, which was unanimously adopted on October 31, 1995 by the FAO Conference, provides the necessary framework for national and international efforts to ensure sustainable exploitation of aquatic living resources in harmony with the environment. It was the culmination of two years of negotiation and the result of five formal meetings, principally in the form of technical consultations.

How the Code Works:

The Code is voluntary. FAO's role is to technically support the implementation of the Code by Governments who bear the responsibility for the development and implementation of national fishery policies.

The Code's implementation will be most effectively achieved when Governments are able to incorporate its principles and goals into national fishery policies and legislation. To ensure that there is support for these policies and legislative changes, Governments should take steps to consult with industry and other groups to promote their support and voluntary compliance. In addition, Governments should encourage fishing communities and industry to develop codes of good practice that are consistent with, and support, the goals and purpose of the Code of Conduct. These codes of good practice are another important way of promoting the implementation of the Code (FAO 2001).

FAO, in accordance with its mandate, is fully committed to assisting its Member States, particularly developing countries, in the efficient implementation of the Code of Conduct for Responsible Fisheries.

Code reporting and review:

FAO will report to the United Nations community on the progress achieved and further action required in the implementation of the Code. The Code is not intended to be static. It is anticipated that the Code may be revised by FAO's competent bodies as well as by states and organizations adopting parts of it.

The Code of Conduct has been supplemented by the development of further documents under its general framework, namely: 1) the FAO Technical Guidelines on Responsible Fisheries; and 2) International Plans of Action (IPOAs) on specific issues identified in the Code: seabirds; sharks; management of fishing capacity; and IUU fishing. The IPOA-IUU reinforces the obligation of states under the Compliance Agreement to ensure that fishing vessels operating in areas beyond the limits of national jurisdiction have the requisite authorization to fish in such areas, and elaborates on such issues as the requirement for effective control of flag vessels, economic measures, control of nationals, port state measures, international cooperation and the implementation of existing obligations in international law (Breide and Saunders 2005).

2. Code of Practice for Marine Scientific Research (MSR) in Cold Water Corals 42/

Who initiated the development of the code:

Irish Department of the Environment, Heritage and Local Government

Code content and format:

The code is not designed to prevent or restrict MSR from being conducted within the designated areas but to provide a transparent framework for the adoption of best environmental practices that will ensure that the activity is pursued on a sustainable basis and to the highest operating standards.

The MSR code of practice contributes to site management by assessing the potential impacts of activities on the marine environment. If the proposed activity is unlikely to have a significant adverse effect on the integrity of the site, consent for the activity may be granted immediately. However, if it poses some risks to the site, the Minister is obliged to seek an appropriate assessment of the implications of the plan or project on the site's conservation before granting consent. The MSR code of practice was specifically developed for MSR cruises in the Special Areas of Conservation of the Irish EEZ, namely: North-West Porcupine Bank, South-West Porcupine Bank, Hovland Mound Province, and Belgica Province. It offers some transparency and guidance to the national and international community in the MSR consent process.

Intended users:

National and international communities undertaking research activities in the Special Areas of Conservation of the Irish EEZ.

Development of the code:

Irish authorities do not consider MSR to be not directly connected or necessary to the conservation of a site under the Habitats Directive, a Council Directive aimed at contributing toward ensuring biodiversity through conservation of natural habitats and of wild fauna and flora in the European territory of the Member States of the Community. On June 1, 2006, four marine sites off the west and south-west coasts of Ireland were proposed as Special Areas of Conservation, namely: North-West Porcupine Bank, South-West Porcupine Bank, Hovland Mound Province, and Belgica Province, covering 2,500 sq. km. of the Irish EEZ. The overarching conservation objective (and legal obligation) for Ireland will be to maintain or restore to favorable conservation status the resident coral reef habitats in the four sites.

42/ Department of the Environment, Heritage and Local Government, Ireland. 2006. Code of Practice for Marine Scientific Research at Irish Coral Reef Special Areas of Conservation. Available: http://www.marine.ie/NR/rdonlyres/8DBA2793-B01E-4576-B2BF-C9403ACD06FA/0/file3654en.pdf

The Habitats Directive provides that “Any plan or project not directly connected with or necessary to the conservation of a site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the sites’ conservation objectives.” Operations or activities that are likely to alter, damage, destroy, or interfere with the integrity of the cold water corals situated in the four sites, such as commercial fishing and petroleum exploitation, are handled by the respective licensing authorities. Other plans or projects that are not currently licensable (e.g., MSR) require the consent of the Minister of Environment, Heritage and Local Government.

The code of conduct was based on: 1) State’s obligations under EU law; 2) State’s international legal obligations, particularly to UNCLOS; and 3) State’s commitments to the OSPAR Commission for the Protection of the Marine Environment in the North-East Atlantic. It was developed through a process that involved risk identification, assessment, and management. The possible types of risk associated with MSR activities conducted in the offshore sector, which have some degree of commonality, were identified along with their respective associated risks. These risks were assessed as to how serious their impact might be if they were to actually happen, and the probability of their occurrence. As a result, risk management approaches and technical measures designed to mitigate against potential risks were provide the following sections of the code: 1) general provisions; 2) remotely operated vehicles (ROVs); benthic sampling; 3) moorings deployment; 4) fishing gear; 5) seismic survey; 6) near-bottom towing; and 7) reporting. The code will also provide an evaluation and appeals process.

Code reporting and review:

It is noted that the Irish authorities intend to fulfill its obligations under UNCLOS, which: 1) obliges States and competent international organizations that undertake MSR in another State’s EEZ or continental shelf to grant full access to, and copies of, data collected and assessments of such data, to the coastal State; and 2) requires that research results are made internationally available.

3. Code of Conduct for Hydrothermal Vent Research: “InterRidge statement of commitment to responsible research practices at deep-sea hydrothermal vents” 43/

Who initiated the development of the code:

InterRidge, a non-profit organization of hydrothermal vent researchers concerned with promoting all aspects of mid-ocean ridge research, has developed a code of conduct for hydrothermal vent research. InterRidge is directed by a steering committee made up of representatives from 11 member nations, representing not only their own national scientists but also those from an additional 17 corresponding nations.

Code content and format:

The Code is a statement of commitment affirming the researchers’ commitment to responsible research activity at hydrothermal vents. It contains guidelines on what activities to avoid, in particular those that will have deleterious impacts on the sustainability of populations of hydrothermal vent organisms. It also encourages researchers to maximize the use of all biological, chemical, and geological samples collected through collaborations and cooperation among the global community of scientists.

The code is also an expression of the researchers’ commitment to international sharing of data, ideas, and samples in order to avoid unnecessary re-sampling and impact on hydrothermal vents, and to further global understanding of hydrothermal vents for the common good.

Intended users:

All scientists and members of the international research community

43/ InterRidge. 2006. InterRidge statement of commitment to responsible research practices at deep-sea hydrothermal vents. Available: http://www.interridge.org/

Development of the code:

The motivation behind the development of the code was the consensus among hydrothermal vent researchers on the growing conflict between observational monitoring activities that depend on vent sites remaining in an undisturbed state and those activities that involve manipulating or collecting biological or geological samples from a particular area. The idea of a code of conduct was introduced by L. Glowka (Glowka 1999) and subsequently discussed in a workshop organized by InterRidge in 2000 on the Management and Conservation of Hydrothermal Vent Ecosystems. Participants in that workshop agreed that concentrated sampling and instrument deployments have resulted in use conflicts between researchers with different research approaches and that concentrated sampling puts pressure on vent biological communities, exacerbated by the relatively small areas that animals tend to occupy on the surfaces of and below the surface of the venting structures. They also agreed that criteria were needed to identify critically important sites and that [conservation] efforts should focus on the most visited sites whether within or beyond the limits of national jurisdiction. The issue was again discussed at the Second International Symposium on Deep-Sea Hydrothermal Vent Biology in 2001 (Glowka 2003). The code was eventually adopted by InterRidge in February 2006.

How the Code Functions:

The code could be applied, either as an intermediate step towards the application of more detailed rules, or to supplement the application of existing legislation. The code of conduct may also be useful in situations where MSR activities involve hydrothermal vents where no legislation exists or is planned. The code could thus also be used within the Area (the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction, UNCLOS, Article 136).

Particularly within the Area, the scientific community's voluntary actions would contribute to the conservation and sustainable use of hydrothermal vents and their associated biodiversity and thereby benefit humankind as a whole, helping to add some meaning to UNCLOS article 143(1), i.e., that marine scientific research should be carried out for peaceful purposes and for the benefit of the whole mankind. This would also be in keeping with the spirit of the CBD's international cooperation provisions and its declaration that biodiversity conservation is a "common concern of humankind."

Conditions for success: 1) principles, 2) involvement of participants in its formulation. 3) incentives, 4) peer pressure, 5) concretized by an IGO.

4. Code of Practice for Ocean Mining 44/

Who initiated the development of the code:

A code of practice for ocean mining was developed by the International Marine Minerals Society (IMMS) in 2001 and formally adopted in 2002.

Code content and format:

The code provides general guiding principles for development of marine mineral resources as well as 11 operating guidelines for application at specific mining sites (IMMS 2001). The operating guidelines serve as benchmarks for industry and targets for regulatory agencies and other stakeholders in assessing actual and intended applications of environmental practice (Jones and Morgan 2003). The operating guidelines cover the areas of: 1) sustainable development; 2) environmentally responsible company ethic; 3) community partnership; 4) environmental risk management; 5) integrated environmental management; 6) company environmental performance targets; 7) environmental improvement and upgrading; 8) rehabilitation and decommissioning; 9) reporting and documentation; 10) archiving; and 11) performance reviews (IMMS 2001).

44/ Jones, A.T. and C.L. Morgan. 2003. Code of Practice for Ocean Mining: An International Effort to Develop a Code For Environmental Management of Marine Mining. Marine Georesources and Geotechnology 21:105-114.

Intended users:

It is intended for marine mining companies, government authorities, non-government organizations, communities, and other stakeholders at marine mining sites (Jones and Morgan 2003).

Development of the code:

The code has drawn on previous marine mining environmental statements, such as the international guidelines for offshore mineral exploration and development developed through a workshop organized by the South Pacific Applied Geoscience Commission (SOPAC) in 1999, and offshore mineral policies developed by coastal states such as Fiji, Solomon Islands, and Australia. Additionally, the code has drawn on the experience of industry personnel and marine environment scientists and engineers who had been involved in environmental assessments related to diamond mining industry; dredging industry; and marine disposal of coastal mining tailings (Jones and Morgan 2003).

Furthermore, the code draws from globally extensive deep water experience of UK, USA, the former USSR, Japanese, German, French, Australian, Indian, and Danish oceanographers and marine biologists who had worked on biodiversity assessments of hydrothermal vents, nodule and crust fields, metalliferous muds, and abyssal plains since the time of the Challenger Expedition in 1873-1876 (Jones and Morgan 2003).

Code reporting and review:

Companies adopting the code write reports that demonstrate the company's commitment to and implementation of the code. The code is up for review by the IMMS in 2007 (Jones and Morgan 2003).

5. Good and Best Practices for Offshore Oil and Gas Operation s45/

Who initiated the development of the code:

The Energy and Biodiversity Initiative (EBI)

Code content and format:

This is a compilation of good and best practices in the prevention and mitigation of primary and secondary biodiversity impacts of upstream oil and gas operations drawn from those that are well known and that have been shown to be effective when used appropriately. It represents a menu of sound biodiversity conservation practices from which can be chosen the most appropriate measures that fit the operational and geographic setting.

The impacts and related preventive and mitigative measures provided in the volume cover the entire project lifecycle, with the exception of the pre-bid phase, where there are no physical impacts, including: 1) seismic activity; 2) exploration; 3) field development; 4) production; 5) transmission; and 6) decommissioning.

In general terms, preventive measures should take priority over those that are mitigative in nature; prevention may be more efficient and cost-effective than mitigation, in addition to the reputational benefits of avoiding impacts rather than addressing them once they have already occurred. However, prevention may not always be technically feasible or economically viable, and therefore, a mixture of preventive and mitigative measures typically represents the optimum solution.

Intended users:

This document is mainly aimed at corporate officers, site managers, and other relevant personnel responsible for the management, monitoring, and conservation of biodiversity throughout the lifecycle of upstream oil and gas operations.

45/ Energy and Biodiversity Initiative. n.d. Good Practice in the Prevention and Mitigation of Primary and Secondary Biodiversity Impacts. Offshore Operations. pp. 18-26. Available: http://www.theebi.org/pdfs/practice.pdf

Code reporting and review:

It is important to recognize that not all impacts will occur in every case, nor will all good practices identified be appropriate for implementation in all cases. Similarly, as the practices identified in the tables have been largely drawn from the literature, they are not all-inclusive. As best practice continues to develop so will new approaches and technology become available. In all cases, full and complete compliance with all applicable laws and regulations must be the starting point for all phases of oil and gas activities.

6. Micro-Organisms Sustainable use and Access regulation International Code of Conduct (MOSAICC) 46/

Who initiated the development of the code:

Belgian Co-ordinated Collections of Micro-organisms (BCCM)

Code purpose:

The Code of Conduct addresses the need for easy transfer of microbial genetic resources (MGRs) and monitoring the process. These are deemed necessary because access to MGRs is a prerequisite for the advancement of microbiology, and because monitoring the transfer of MGRs is necessary to identify the individuals or groups that are entitled to rewards for their contribution to the conservation and sustainable use of the MGRs. The Code, therefore, aims to: 1) facilitate access to MGRs; and 2) help partners to make appropriate agreements when transferring MGRs.

Code content and format:

MOSAICC is a voluntary Code of Conduct, a tool to support the implementation of the Convention on Biological Diversity (CBD, Rio de Janeiro, June 5, 1992), at the microbial level, in accordance with other relevant rules of international and national laws. Its operating principles are the identification of the origin of the MGRs and the monitoring of their transfer, as follows:

a) Identification of the origin: *in situ* origin of the MGRs is identified via initial Prior Informed Consent (PIC) procedure providing authorization for sampling; *in situ* origin of the MGRs is always mentioned when transfer occurs.

b) Monitoring of transfer of MGRs occurring under Material Transfer Agreement (MTA), the terms of which are defined by both recipient and provider. The MTA is a generic term that can cover either a very short shipment document, a simple standard delivery notice, a standard invoice containing minimal standard requirements, or a more detailed specific contract including tailor-made mutually agreed terms. All these documents can be designated as MTA as long as they contain at least the following: information on the *in situ* origin; information on provider and recipient; mutually agreed terms defined by two main criteria: the use of MGRs (test, research, commercial use) and the distribution of MGRs. According to the use and intended distribution of the MGRs, mutually agreed terms can be either short or very detailed.

Intended users:

Microbiologists and countries providing microbial genetic resources

Development of the code:

The BCCM, motivated by having experienced improvement in their capacity for conservation, handling and study of microbial resources through collaborative efforts, and managerial co-ordination at consortium level, strongly believes that at the global level there is no future for culture collections without equitable and fair networking.

46/ The information provided on MOSAICC is drawn from documents posted in the Belgian Co-ordinated Collections of Micro-organisms (BCCM) website, including: the Code of Conduct; Summary of the Code of Conduct; MOSAICC Brochure (http://bccm.belspo.be/projects/mosaicc/index.php).

For the BCCM, cooperation at regional and world levels also means involvement, as a consortium as well as individual collections, in international organizations such as the European Culture Collections' Organisation (ECCO), World Federation for Culture Collections (WFCC), and UNESCO Microbial Resources Centres Network (MIRCEN). Likewise, it means active participation in projects that facilitate global communication and cooperation between collections.

The BCCM therefore launched a collaborative project entitled *MOSAICC (Micro-Organisms Sustainable use and Access regulation International Code of Conduct)* in September 1997-May 1999 with the support of the Directorate General XII for Science, Research and Development of the European Commission. The project involved 13 partners, including representatives from North and South, as well as representatives from both the non-profit and the commercial sectors:

1. OECD - Organisation for Economic Co-operation and Development (France)
2. Biotechnology Unit, Directorate of Science, Technology and Industry
3. IUCN - World Conservation Union, Environmental Law Centre (Germany)
4. The Royal Botanic Gardens KEW, Herbarium, Conventions and Policy Section (UK)
5. Novo Nordisk A/S, Department of External Relations (Denmark)
6. IMI - International Mycological Institute, Department of Mycology (UK)
7. WFCC - World Federation for Culture Collections, WFCC - Biodiversity Committee (UK)
8. IPM - Industrial Platform for Microbiology (Belgium)
9. CCT- Fundacao Tropical Andre Tosello, Colecao de Culturas Tropical (Brazil)
10. INBio - Instituto Nacional de Biodiversidad, Department of Bioprospection (Costa Rica)
11. UICC - Universitas Indonesia Culture Collection, Laboratory of Microbiology (Indonesia)
12. ARC - Agricultural Research Council, Plant Protection Research Institute (Republic of South-Africa) and
13. BCCM - Belgian Co-ordinated Collections of Micro-organisms as co-ordinator (Belgium)

<u>How the Code Functions:</u>

The Code provides the terms of access to MGRs, including Prior Informed Consent (PIC): definition and contents; procedure for access to *in-situ* MGRs; procedure for access to *ex-situ* MGRs; settlement of Material Transfer Agreement; monitoring the distribution and utilization of MGRs; some additional terms of agreement; and the model documents for PICs and MTAs.

The Code also provides a flowchart that guides decision-making throughout the whole process of accessing and transferring MGRs.

<u>Code reporting and review:</u>

There is no information available on how the Code of Conduct is disseminated among its target users and how useful or effective the Code has been in achieving its purpose.
