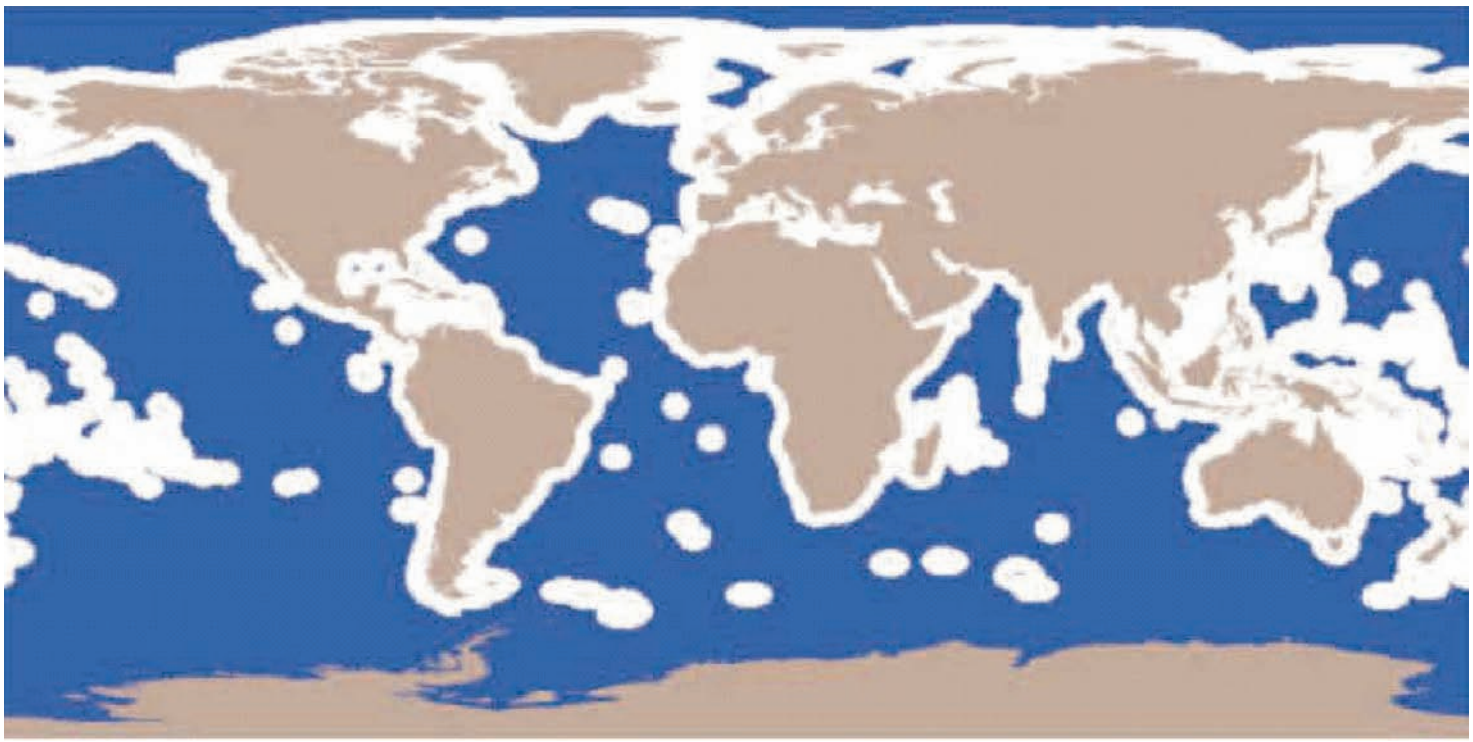
Strategic Planning Workshop on Global Oceans Issues in Marine Areas Beyond National Jurisdiction in the Context of Climate Change

Briefing Volume on Key Sources of Information



January 23-25, 2008

Nice, France

United Nations Educational, Scientific and Cultural Organization

SINGAPORE

CANADA

UNIVERSITY OF DELAWARE

world ocean network

NAUSICAA

Note from the Workshop Secretariat: ***Key sources of information may be accessed through links to their original publication source as well as through links to copies on the Global Forum website as indicated on pages 23-24 in this volume.***

Briefing Volume on Key Sources of Information

Table of Contents

1. The status of scientific knowledge regarding marine areas beyond national jurisdiction

Overview – Scientific understanding of ecosystems in marine areas beyond the limits of national jurisdiction

The current debate on the high seas within the United Nations has focused on the following specific ecosystems: seamounts, cold water coral reefs, hydrothermal vents and other ecosystems. This background document provides information about knowledge of these ecosystems, including their distribution, ecology, and the threats they are facing.

Seamounts

Seamounts are isolated mountains or mountain chains beneath the surface of the sea. They are generally formed over upwelling plumes (hotspots) and in island arc convergent settings. Hotspots are points of frequent volcanic activity in the earth's crust persisting over millions of years.

Because seamounts do not break the sea surface, knowledge of their distribution comes primarily from remote sensing, which is unlikely to be able to comprehensively map all seamounts in the world. According to the Census of Marine Life project on seamounts (CenSeam), there are potentially up to 100,000 seamounts over 1 km high and many more of smaller elevation. They are found in every ocean basin and most latitudes, although nearly half of the world's known or inferred seamounts are found in the Pacific Ocean.

Relatively few seamounts have been studied, with only about 350 having been sampled. Of these, fewer than 200 have been studied in any detail, many in waters within national jurisdiction. Although seamount biodiversity is still poorly understood on a global scale due to lack of sampling and exploration, available research results suggest that seamounts are often highly productive ecosystems that can support high biodiversity and special biological communities, including cold water coral reefs, as well as abundant fisheries resources. Some evidence suggests high levels of endemic species on seamounts, although these levels may vary between individual seamounts, regions and taxa. According to the Census of Marine Life, "seamounts represent important ecosystems for study that have not, to date, received scientific attention consistent with their biological and ecological value."

Seamount ecosystems may be vulnerable because of their geographical isolation, which for some species may indicate genetic isolation. They are also vulnerable because of the characteristics of their associated species, which include cold water coral reefs that are fragile to physical disturbances from destructive practices such as bottom trawling, and long-lived, slow-growing fish species that are intrinsically vulnerable to fishing. Consequently, the biggest current threat to seamounts comes from fishing activities. Other threats include the mining of deep water corals associated with seamounts for the jewellery trade, bioprospecting, potential future seabed mining related to mineral resources of ferromanganese crusts and polymetallic sulphides (from vents, which may

occur at some younger seamounts). Climate change may also present a future threat as seamount community structure may change because of differences in species' thermal preference and changes in ocean current patterns.

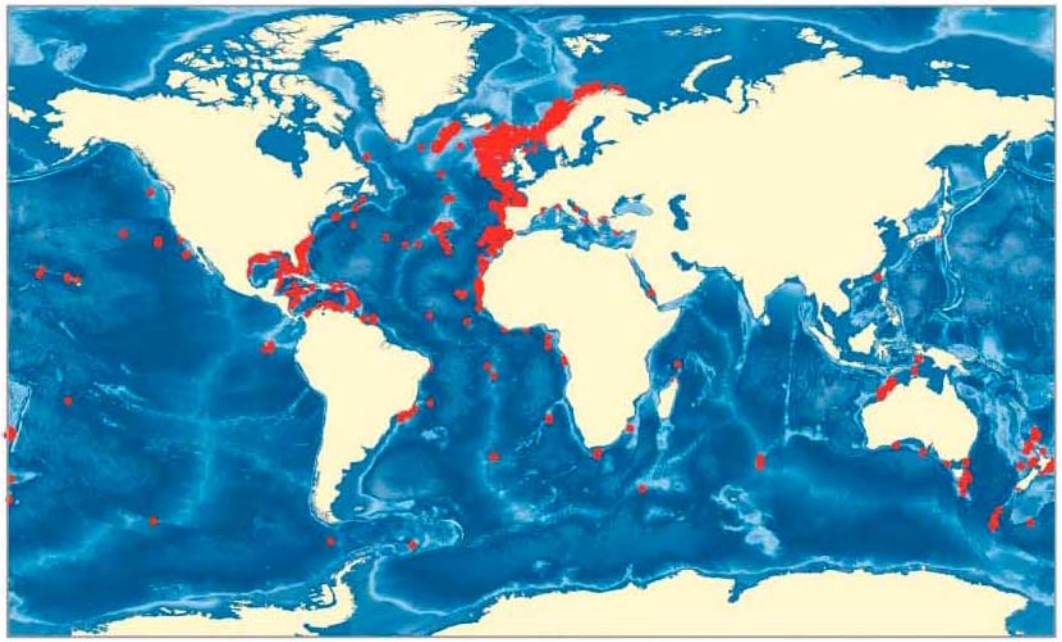


Figure 1. Current global distribution of reef framework–forming cold-water corals [modified from Freiwald et al. 2004]. Source: Roberts et al. (2006).[1]

Cold water coral reefs

Cold-water corals include stony corals (Scleractinia), soft corals (Octocorallia), black corals (Antipatharia), and hydrocorals (Stylasteridae). They are widely distributed and have thus far been found in the Atlantic, Mediterranean, Indian, Pacific and Southern oceans see Figure 1). Most of the cold water corals discovered to date appear to be on the edges of the continental shelf or on seamounts. The total area covered by cold water coral reefs globally is still unknown, although studies indicate that coverage could equal, or exceed, that of warm-water reefs. A conservative estimate of cold water coral reef coverage is 284,300 km^2.

There are still large gaps in our understanding of the distribution of cold water coral reefs, their biology and ecology. These gaps are mainly due to the difficulty of researching these environments, where observation and sampling often require expensive ship time and sophisticated equipment. Our current knowledge consists of a series of snapshots of well-studied reefs, most of which are located in the higher latitudes, including the intensively mapped and studied *Lophelia reefs* in Norway. We do know that cold water corals grow slowly, at only a tenth of the growth rate of warm-water tropical corals.

[1] Roberts, J.M., A.J. Wheeler and A. Freiwald. 2006. *Reefs of the Deep: The Biology and Geology of Cold-Water Coral Ecosystems.* Science 312:543-547.

Many of them produce fragile calcium carbonate skeletons that resemble bushes or trees and provide habitat for associated animal communities.

There is no doubt that cold-water coral reefs support diverse communities of unique species. These species include invertebrates and economically important fisheries species. Thus, cold-water coral reefs may be considered biodiversity hotspots in the open ocean.

Major threats to cold-water corals include destructive fishing practices, such as bottom trawling, other bottom-contact fishing (e.g. mid-water trawls may drag the bottom, long lines may snag on corals), hydrocarbon drilling, seabed mining, ocean acidification and direct exploitation. Of these, ocean acidification presents a potentially serious future threat.

The overall ecological health status of cold water coral reefs is unknown. Most of the reefs studied thus far show physical damage from trawling activities. Only in a few cases has this damage been quantified. The rate of regeneration and recovery of once-damaged cold water coral reefs is unknown, but is estimated to be on the scale of decades to centuries for a reef to regain ecological function owing to the very slow growth rate of cold water coral reefs.

Hydrothermal vents

The discovery of hydrothermal vents along the Galapagos Rift in the eastern Pacific in 1977 arguably represented one of the most important findings in biological science in the latter quarter of the twentieth century. Hydrothermal vents were the first ecosystem on Earth found to be independent from the sun as an original source of energy, relying instead on chemosynthesis. Hydrothermal vents are now known to occur along all active mid ocean ridges and back-arc spreading centres. The InterRidge Hydrothermal Vent Database currently lists 212 separate vent sites, though more are likely to exist.

Our knowledge about where hydrothermal vents occur, and how extensive they are, is far from complete. Hydrothermal activity does not take place everywhere along mid-ocean ridge systems. Since the 1990s, there have been large-scale, systematic searches for undiscovered vent sites. Many of these searches rely on inferring the presence of vents from water column observations by measuring optical properties, temperature and particle anomalies, as well as chemical tracers that distinguish hydrothermal plumes from the surrounding seawater.

There are also knowledge gaps in regards to the biodiversity and ecology of hydrothermal vent ecosystems, and their interactions with surrounding communities. Generally, biomass of hydrothermal vent communities is high but biodiversity is low. Endemism is high, with 91% of species that have been discovered from hydrothermal vents to date being endemic. Vent sites support exceptionally productive biological communities in the deep sea, and vent fauna range from tiny chemosynthetic bacteria to tube worms, giant clams, and ghostly white crabs. Many species are exclusive to these ecosystems and would be unable to exist outside them.

The only currently documented anthropogenic impacts to hydrothermal vent ecosystems in areas beyond the limits of national jurisdiction result from marine scientific research. However, the mining of polymetallic sulphide deposits associated with hydrothermal vents presents a potentially much more serious and urgent threat to vent ecosystems, and is moving closer to becoming a reality, at least within national EEZs. Bioprospecting of hydrothermal vent organisms is already taking place, and some have been used for the purposes of biotechnology. High-end tourism presents another potential future threat to vent ecosystems.

Other ecosystems

Other ecosystems include pelagic habitats, as well as benthic sponge reefs and fields, cold seeps and abyssal plains.

Pelagic habitats

Species diversity in the pelagic environment is generally lower than in the benthic environment despite the far greater volume of the pelagic environment. The lower diversity in pelagic systems may be a result of their openness, which allows for rapid and widespread gene flow through pelagic communities. However, the pelagic ecosystem is far from uniform in terms of productivity, and distinct hot spots exist in the world's oceans. The pelagic ecosystem is fuelled by phytoplankton primary production. Herbivorous zooplankton graze on phytoplankton, and in turn support predators including fish. Many pelagic species, ranging from krill to tunas and marine mammals, migrate during different stages of their different life history.

Many pelagic species are threatened directly or indirectly by commercial fishing. Pelagic fishes are caught as target species and as by-catch. Following a long history of intensive exploitation of large pelagic fish, and the global expansion of longline fisheries since the 1950s, predators such as sharks and tunas have declined drastically (one study indicates a 90% decline over 50 years), although the magnitude of the decline is still being debated. Bycatch by pelagic gillnet and longline fishing continues to kill marine mammals, seabirds and sea turtles. Bioaccumulation of chemical contaminants poses threats to the health of pelagic animals, particularly top predators.

Climate change may have a potentially large impact on pelagic systems in the high seas. Dynamics of pelagic systems depend largely on sea water temperature and current flow patterns, which affect the magnitude and temporal and spatial distribution of primary productivity. These factors, in turn, affect the distribution of zooplankton, pelagic fishes and other pelagic megafauna. Carbon sequestration, a proposed strategy to combat climate change, may also present a threat.

Sponge reefs

Sponge reefs, which are formed by glass sponges with three-dimensional silica skeletons, are built in a manner similar to coral reefs, by new generations growing on previous ones. Sponge stalk communities can be found on the soft mud bottom of the deep sea throughout the world's oceans between the depths of 500 and 3,000m. Despite their worldwide distribution, the main occurrences of sponge reefs are in cold waters

associated with bathymetric and topographic structures, such as seamounts, continental slopes and underwater canyons, where fast-flowing, nutrient-rich deepwater currents can be found. However, our current knowledge of the global distribution of sponge reefs is incomplete and biased by insufficient sampling.

Similar to cold water coral reefs, sponge reefs are slow-growing and long-lived. Their growth rate is generally two to seven cm per year and they can live to be up to 6,000 years old. Sponges provide habitat for many species, including invertebrates and commercially important fish. The invertebrate diversity associated with sponges is high.

The threats facing sponge reefs are similar to those facing cold-water coral reefs, and include destructive fishing practices such as bottom trawling, other bottom-contact fishing (e.g., mid-water trawls, long lines), hydrocarbon drilling, seabed mining and direct exploitation. Many sponge reefs show impact of bottom fishing activities, and sponges are common as bycatch from fishing operations. Sponge reefs may also be of future interest for bioprospectors.

Cold seeps

Cold seeps are deep soft-bottom areas where oil or gases seep out of the sediments. "Seepage" encompasses everything from vigorous bubbling of gas from the seabed to the small-scale emanation of microscopic bubbles or hydrocarbon compounds in solution. Seep fluids contain a high concentration of methane. Cold seeps are found along the world's passive and active continental margins at depths extending from 400 m to over 7000 m.

There are still knowledge gaps relating to the distribution, biodiversity and ecology of cold seeps. Cold seeps are known to support relatively high diversity. Over 210 species have been reported from cold seeps. This is very likely an under-estimate because of insufficient samples and poor taxonomic identification of cold-seep assemblages. The rate of endemism is high.

Threats to cold seeps include bottom fishing activities. Recent research reports from New Zealand record evidence of trawl damage, including extensive areas of coral rubble, as well as lost fishing gear on cold seeps. Oil, gas and mineral exploration are potential threats to cold seep biodiversity. At the present time, such exploration occurs mainly on the continental shelf. However, the rich oil, gas and mineral reserves at or near cold seeps beyond national jurisdiction may attract exploration in the future, thus threatening their associated communities.

Abyssal plains

Abyssal plains cover almost 50% of the deep seabed, and are comprised mainly of mud flats. There is a relatively high diversity of animals living in and on deep-sea sediments, including bottom-dwelling fishes, sea cucumbers, star fishes, brittle stars, anemones, glass sponges, sea pens, stalked barnacles, mollusks, worms and small crustaceans. However, despite the large number of rare animals, a few species make up the individuals

in deep-sea samples. The most diverse species are macrofauna, small animals of up to 1mm in size.

Key source attached to this document[2]

- Convention on Biological Diversity (CBD). 2006. Scientific Information on Status and Trends of, and Threats to, Deep Seabed Genetic Resources beyond National Jurisdiction. Note by the Executive Secretary pursuant to SBSTTA recommendation XI/8. 10 February 2006. Available: http://www.biodiv.org/doc/programmes/areas/marine/marine-status-en.doc

Other important documents

Clark M.R., Tittensor D., Rogers A.D., Brewin P., Schlacher T., Rowden A., Stocks K., Consalvey M. (2006). Seamounts, deep-sea corals and fisheries: vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction. UNEP-WCMC, Cambridge, UK. Available: http://www.cbd.int/doc/meetings/mar/ewsebm-01/other/ewsebm-01-clark-en.pdf

Convention on Biological Diversity (CBD) (2005) 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). See: http://www.biodiv.org/doc/meetings/sbstta/sbstta-11/official/sbstta-11-11-en.doc

CBD. 2006. Global Coastal and Marine Biogeographic Regionalization as a Support tool for Implementation of CBD Programmes of Work. Note from the Executive Secretary. 21 February 2006. UNEP/CBD/COP/8/INF/34. 21 February 2006. Available: http://www.biodiv.org/doc/meetings/cop/cop-08/information/cop-08-inf-34-en.pdf

CBD.2007. synthesis and review of the best available scientific studies on priority areas for biodiversity conservation in marine areas beyond the limits of national jurisdiction. An information document for SBSTTA 13.

Freiwald, A., J.H Fosså, A. Grehan, T. Koslow and J. M. Roberts. 2004. Cold-water Coral Reefs. UNEP-WCMC, Cambridge, UK.

Freiwald, A. and Roberts, J.M. (eds.) 2005. Cold-water Corals and Ecosystems. Springer-Verlag Berlin Heidelberg

[2] The sources noted as "attached to this volume" are on the Global Forum website and maybe downloaded by participants through links on pages 23-24.

Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) 2007. Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK. (in press).

Roberts JM, Wheeler AJ, Freiwald A. 2006. Reefs of the deep: the biology and geology of cold-water coral ecosystems. Science 312:543-547

Rogers, A.D. 2004. The Biology, Ecology and Vulnerability of Deep-Water Coral Reefs. Report for the World Conservation Union for the 7th Convention of Parties, Convention for Biodiversity, Kuala Lumpur, February 8th – 19th. 8pp. Available at Available at http://www.iucn.org/themes/marine/pubs/pubs.htm

Van Dover, C. 2000. The Ecology of Deep-Sea Hydrothermal Vents (Princeton University Press).

United Nations Environment Programme (UNEP). 2006. Ecosystems and biodiversity in deep waters and high seas. UNEP Regional Seas Reports and Studies No. 178. UNEP/IUCN Switzerland 2006.

United Nations General Assembly (UNGA). 2005. Oceans and the law of the sea Report of the Secretary-General. Addendum. Document A/60/63/Add.1 presented 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. See: http://daccess-ods.un.org/access.nsf/Get?Open&DS=A/60/63/Add.1 &Lang=E

2. Human uses of marine areas beyond national jurisdiction

Overview – Human uses of marine areas beyond the limits of national jurisdiction

Current human uses of marine areas beyond the limits of national jurisdiction include capture fisheries and aquaculture, shipping, marine scientific research, bioprospecting, tourism, oil and gas extraction, mining, deep sea cable and pipeline industry, disposal of nuclear waste or other substances, and military uses. New and emerging uses of marine areas beyond national jurisdiction may present new opportunities in which to utilize ocean resources, but also may have unknown impacts on these areas. Such uses include carbon sequestration, ocean fertilization, and floating energy and mariculture facilities, among others. Continued research on these new and emerging uses will provide essential information on how to best reap the benefits, as well as mitigate any negative impacts.

Human uses of marine areas beyond national jurisdiction produce important benefits to human economies and livelihoods.

The Workshop will consider the benefits and problems/opportunities related to three industries operating in areas beyond national jurisdiction: fishing, submarine cables, and maritime transportation.

In general, the economic and social values and perspectives on future problems/ opportunities of various ocean industries have not been well documented and aggregated. To remedy this gap, the Global Forum on Oceans, Coasts, and Islands, together with industry and UNIDO, will be developing a study on the economic and social values associated with these industries and the outlooks of industry leaders on constraints, challenges, and opportunities they will be facing in the next decade.

Human uses may also have impacts on the marine environment and biodiversity. The following lists some of the key issues associated with various human uses. Table 1 provides some options and relevant actors for preventing and mitigating identified threats:

- the capture fisheries sector continues being affected by shortage of resources, mainly due to unsustainable exploitation practices and underlying causes related to fisheries governance;

- illegal, unreported and unregulated (IUU) fishing has adverse ecological impacts, but also the economic and social costs of it are significant and result in increased costs, lower employment, lower incomes and lower export revenues for legal fishers and adverse effects on the livelihoods of developing country fishing communities due to the reduction of the resources on which those livelihood systems are based;

- there are difficulties in keeping track of scientific research and monitoring activities in the open ocean and deep sea environments;

- there are issues related to cruise ship wastes, whose disposal is generally unregulated, as well as to the adverse economic and social effects that cruise tourism can entail;

- in the marine environment, extractive activities for the purpose of energy development remain a major economic industry. In marine areas afar from the coastline, the main extractive activity related to energy production is offshore oil and natural gas. The occupation of certain areas for the purpose of energy production may conflict with other uses and also entail environmental effects in those areas;

- mining in the seabed, the ocean floor and subsoil beyond national jurisdiction ('the Area') is organized and controlled by the International Seabed Authority (ISA) according to relevant provisions under the United Nations Convention on the Law of the Sea. The Authority coordinates expert work on environmental effects of mining and on exploring linkages between non-living and living resources in the Area, but its mandate relates to non-living resources solely;

- despite their relatively limited direct uses of ocean's spaces and resources in areas beyond national jurisdiction, indigenous and local communities seem to have well-defined expectations as stakeholders (in the general sense of the term as including rightholder) with regard to marine biodiversity in areas beyond national jurisdiction.

An integrated approach to the study and management of the ocean's spaces and resources would imply that all actual stakeholders, directly as well as indirectly involved, be identified and consulted in an appropriate manner. Future work is needed in this regard.

Key source attached to this document[3]

- UNU-IAS. 2006. Implementing the Ecosystem Approach in Open Ocean and Deep Sea Environments - An Analysis of Stakeholders, their Interests and Existing Approaches. UNU-IAS Report. http://www.ias.unu.edu/binaries2/DeepSea_Stakeholders.pdf

Other important documents

CBD. 2005. The International Legal Regime of the High Seas and the Seabed Beyond National Jurisdiction. CBD Technical Report No. 19. http://www.cbd.int/doc/publications/cbd-ts-19.pdf

International Cable Protection Committee. About Submarine Telecommunications Cables.

[3] The sources noted as "attached to this volume" are on the Global Forum website and maybe downloaded by participants through links on pages 23-24.

An informative presentation on submarine cables, and their role in today's world. Available: http://www.iscpc.org/About_Cables_LowRes/About_SubTel_Cables_LowRes_Rev7.pps.

Table 1. Summary of threats to selected seabed habitats, and options and relevant actors for preventing and mitigating identified threats[4]

Existing and potential threats	Existing options	Options under development	Relevant actors
Hydrothermal vents			
Existing • Marine scientific research with destructive impacts • Bioprospecting *Potential* • Mining of polymetallic sulphide deposits associated with vent systems • Submarine-based marine tourism	• 2006 InterRidge statement of commitment to responsible research practices at deep sea hydrothermal vents • The Commitment to Responsible Marine Research of the Senate Commission on Oceanography of the German Research Foundation (DFG) and the German Marine Research Consortium (KDM) • CBD Voluntary guidelines on biodiversity-inclusive environmental impact assessment	• Code of conduct for marine protected areas in the Azores Triple Junction • International Seabed Authority (ISA) draft regulations on prospecting and exploration for polymetallic sulphides and cobalt-rich ferromanganese crusts in the Area [5]/ • ISA exploration and mine site model to block selection for cobalt-rich ferromanganese crusts and polymetallic sulphides [6]/ • OSPAR [7]/ code of conduct for scientific research • FAO guidelines for deep-sea fisheries in the high seas	• Organizations undertaking marine scientific research, • Bioprospecting companies • High-end tourism operators and tourists • Deep sea mining companies • Energy development companies • Relevant UN organizations • Regional organizations including the regional seas organizations and regional fishery management organizations (RFMOs) • Developed and developing States • Environmental non-governmental organizations

[4] Source: CBD. 2007. Options for preventing and mitigating the impacts of some activities to selected seabed habitats, and ecological criteria and biogeographic classification systems for marine areas in need of protection. UNEP/CBD/SBSTTA/13/4. 13 November 2007. Available: http://www.cbd.int/doc/meetings/sbstta/sbstta-13/official/sbstta-13-04-en.doc

[5] ISBA/10/C/WP.1Rev.1; ISBA/13/LTC/WP.1

[6] ISBA/12/C/3

[7] The Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention)

Existing and potential threats	Existing options	Options under development	Relevant actors
Cold Seeps			
Existing • Prospecting by the petroleum industry • Destructive fishing practices • Scientific investigation with destructive impacts *Potential* • Direct harvest of seepage minerals	• Code of Conduct for Responsible Fisheries (FAO 1995) and its relevant international plans of action • General Assembly resolution 61/105, on sustainable fisheries, paras. 83-91 • Voluntary guidelines on biodiversity-inclusive environmental impact assessment • Micro-organisms sustainable use and access regulation international code of conduct (MOSAICC) • Code of practice for ocean mining (IMMS 2002) • Management measures developed by regional fisheries management organizations or arrangements, e.g. the South Pacific RFMO and the Northwest Atlantic Fisheries Organizations • The Commitment to Responsible Marine Research of the Senate Commission on Oceanography of the German Research Foundation (DFG) and the German Marine Research Consortium (KDM) •	• ISA draft regulations on prospecting and exploration for polymetallic sulphides and cobalt-rich ferromanganese crusts in the Area • Management measures in line with General Assembly resolution 61/105, on sustainable fisheries, bottom fisheries measures, paras.83-86, to be developed by regional fisheries management organizations or arrangements and flag States • OSPAR code of conduct for scientific research • FAO guidelines for deep-sea fisheries in the high seas	• Oil and gas companies • Organizations undertaking marine scientific research • Biotechnology companies • Deep sea mining companies • Fishers • Relevant UN organization/s including the International Seabed Authority, • Regional organizations including the regional seas organizations and RFMOs • Flag States • Non-governmental environmental organizations • Developed and developing states
Seamounts			
Existing • Overexploitation of high seas fishing on seamounts • Destructive fishing practices • Mining of deep-water corals associated with seamounts for the jewellery trade *Potential*	• Code of Conduct for Responsible Fisheries (UN FAO 1995) and its relevant international plans of action • General Assembly resolution 61/105, on sustainable fisheries, paras. 83-91 • Management measures developed by regional fisheries management organizations and arrangements, including pursuant to General Assembly resolution 61/105, on sustainable fisheries, e.g. the South Pacific RFMO and the Northwest	• ISA International Seabed Authority draft regulations on prospecting and exploration for polymetallic sulphides and cobalt-rich ferromanganese crusts in the Area • Management measures in line with General Assembly resolution 61/105,	• Fishers • Deep sea mining companies • Relevant UN organization/s • Regional organizations, including the regional seas organizations and RFMOs • Flag States • Non-governmental environmental

Existing and potential threats	Existing options	Options under development	Relevant actors
• Mining of ferromanganese oxide and polymetallic sulphides • Bioprospecting • Possible exploitation of methane gas hydrates • Climate change	Atlantic Fisheries Organizations • Cooperative agreements or arrangements of mutual assistance on a global, regional, sub-regional or bilateral basis • Code of practice for ocean mining (International Marine Minerals Society 2002) Voluntary guidelines on biodiversity-inclusive environmental impact assessment • The Commitment to Responsible Marine Research of the Senate Commission on Oceanography of the German Research Foundation (DFG) and the German Marine Research Consortium (KDM)	on sustainable fisheries, bottom fisheries measures, paras.83-86, to be developed by regional fisheries management organizations or arrangements and flag States • OSPAR code of conduct for scientific research • FAO guidelines for deep-sea fisheries in the high seas	organizations • Developed and developing countries
Cold- water coral and sponge reefs			
Existing • Destructive fishing practices *Potential* • Hydrocarbon drilling and seabed mining • Ocean acidification • Placement of pipelines and cables • Pollution • Research activities • Dumping	• Code of conduct for responsible fisheries (FAO 1995) and its relevant international plans of action • General Assembly resolution 61/105, on sustainable fisheries, paragraphs 83-91 • Management measures developed by regional fisheries management organizations and arrangements, including pursuant to the sustainable fisheries resolution UNGA 61 • Cooperative agreements or arrangements of mutual assistance on a global, regional, subregional or bilateral basis • IMO Code for the Construction and Equipment of Mobile Offshore Drilling Units, 1989 (MODU Code) • Environmental impact assessment and mitigation measures adopted by oil and gas companies as stated in	• Management measures in line with UNGA 61 sustainable fisheries resolution and bottom fisheries measures (OP83-86) to be developed by regional fisheries management organizations or arrangements and Flag States • Technical annex to the draft OSPAR code of conduct for scientific research • FAO guidelines for deep-sea fisheries in the high seas	• Fishers • Scientific researchers and bioprospectors • Biotechnology companies • Oil and gas companies, and end users of oil and gas • Relevant UN organization/s, • Regional organizations, including the regional seas organizations and RFMOs • Flag States • Companies that use cables and pipelines • Environmental non-governmental organizations • Developed and developing countries

[8] Irish Department of the Environment, Heritage and Local Government 2006
[9] Energy and Biodiversity Initiative 2003

Existing and potential threats	Existing options	Options under development	Relevant actors
	environmental impact statements • Code of practice for marine scientific research in cold water corals [8]/ • Voluntary guidelines on biodiversity-inclusive environmental impact assessment • Good and best practices for offshore oil and gas operations [9]/ • The Commitment to Responsible Marine Research of the Senate Commission on Oceanography of the German Research Foundation (DFG) and the German Marine Research Consortium (KDM)		

3. Climate change and marine areas beyond national jurisdiction

Overview – Climate change

While climate change science has made considerable progress, large uncertainties still continue to exist in regards to our understanding of the impacts of climate on change on oceans, their biota and ecology. Much of the current scientific research has focused on climate change impacts in coastal regions, particularly in regards to coral bleaching and sea level rise. Less is known about potential impacts to open oceans and deep seas.

Background

Climate change may bring about large changes in ocean temperature and circulation. In 2006, the German Advisory Council on Global Change (WBGU) released a Special Report, "The Future Oceans – Warming up, Rising High, Turning Sour" which shows that climate change is having severe impacts on the state of the oceans. Three critical processes, ocean warming, ocean acidification and sea-level rise, are a direct outcome of the atmospheric enrichment of pollution with greenhouse gases, especially carbon dioxide. The report emphasizes the need for a rapid response - because of the major time lags, human action now will determine the state of the oceans for many centuries to come. According to the fourth IPCC report, observations since 1961 show that the average temperature of the global ocean has increased to depths of at least 3000 m and that the ocean has been taking up over 80% of the heat being added to the climate system. Most coupled ocean-atmosphere models suggest a weakening of the convective overturning of the ocean in the North Atlantic and around Antarctica, which would affect ocean circulation and could have significant regional impacts on climate. Conditions setting up such changes may be initiated in the 21st century, but the effects may not become evident until centuries later.

Oceanographic changes caused by climate change may affect marine organisms in a variety of ways including their abundance, distribution and breeding and migration cycles. These changes may cause community-level shifts that will affect the functioning of the oceanic ecosystem. In addition, international studies indicate that the productivity of marine systems will be affected by climate change. These changes may also influence the ability of the ocean ecosystems to produce food for human consumption.

This background note summarises some of the key concerns of climate change impacts on ecosystems and species in marine areas beyond the limits of national jurisdiction.

Climate change and the pelagic environment

Climate change may have a potentially large impact on pelagic systems in the high seas. Dynamics of pelagic systems depend largely on sea water temperature and current flow patterns, which affect the magnitude and temporal and spatial distribution of primary productivity. These factors, in turn, affect the distribution of zooplankton, pelagic fishes and other pelagic megafauna. However, the extent to which climate change may threaten species in the pelagic systems requires further research. For example, there is as yet insufficient knowledge about impacts of climate change on regional ocean currents and

about physical-biological linkages to enable confident predictions of changes in fisheries productivity.

Ocean acidification

According to the fourth IPCC report, the uptake of anthropogenic carbon since 1750 has led to the ocean becoming more acidic with an average decrease in pH of 0.1 units. Increasing atmospheric CO2 concentrations lead to further acidification. Projections based on SRES scenarios give a reduction in average global surface ocean pH of between 0.14 and 0.35 units over the 21st century. While the effects of observed ocean acidification on the marine biosphere are as yet undocumented, the progressive acidification of oceans is expected to have negative impacts on marine shell-forming organisms and their dependent species.

Consequently, ocean acidification presents a potentially serious future threat to cold water coral reefs and plankton with calcareous shells (such as foraminifera). Increasing acidification de-saturates aragonite in water, making conditions unfavourable for corals to build their carbonate skeletons. Current research predicts that tropical coral calcification would be reduced by up to 54% if atmospheric carbon dioxide doubled. Because of the lowered carbonate saturation state at higher latitudes and in deeper waters, cold water corals may be even more vulnerable to acidification than their tropical counterparts. Also, 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 inhospitable in the future. It is predicted that 70% of the 410 known locations with deep-sea corals may be in aragonite-undersaturated waters by 2099.

Carbon sequestration

Carbon sequestration is a proposed method for mitigating the impacts of climate change, which may present a threat to ocean habitats and species. It has been suggested that one strategy for combating climate change is to enhance the ocean's natural capacity to absorb and store atmospheric carbon dioxide, either by inducing and enhancing the growth of carbon-fixing plants in the surface ocean, or by speeding up the natural, surface-to-deep water transfer of dissolved carbon dioxide by directly injecting it into the deep ocean. The environmental consequences of this activity are unknown, and the carbon dioxide dumped in the oceans will eventually percolate to the surface and back into the atmosphere.

Key sources attached to this document[10]

- Observations, some current conditions and evaluations on climate change and marine areas beyond national jurisdiction, Dr. Gunnar Kullenberg, former Executive Secretary, Intergovernmental Oceanographic Commission

[10] The sources noted as “attached to this volume” are on the Global Forum website and maybe downloaded by participants through links on pages 23-24.

- German Advisory Council on Global Change. 2006. The Future Oceans – Warming Up, Rising High, Turning Sour. Special Report. Berlin. http://www.wbgu.de/wbgu_sn2006_en.pdf

- World Climate Research Programme Briefing to IOC 2007. Available: http://wcrp.ipsl.jussieu.fr/SF_OceanClimate.html

Other important documents and sources of information

CBD. 2001. Interlinkages between climate change and biodiversity. CBD Technical Report No. 10. http://www.cbd.int/doc/publications/cbd-ts-10.pdf

Gateway to the UN System's Work on Climate Change. Available: http://www.un.org/climatechange/index.shtml

Guinotte, J.M., Orr, J., Cairns, S., Freiwald, A., Morgan, L. and George, R. 2006. Will human-induced changes in seawater chemistry alter the distribution of deep-sea scleractinian corals? Front. Ecol. Environ. 4(3): 141-146.

Hobday, Alistair J., Thomas A. Okey, Elvira S. Poloczanska, Thomas J. Kunz, Anthony J. Richardson (Eds.) 2006. Impacts of climate change on Australian Marine Life. CSIRO Marine and Atmospheric Research report to the Australian Greenhouse Office , Department of the Environment and Heritage. September 2006 http://www.greenhouse.gov.au/impacts/publications/marinelife.html

Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report Climate Change 2007: Synthesis Report. http://www.ipcc.ch/ipccreports/ar4-syr.htm

Ocean Observations Panel for Climate (OOPC). Available: http://ioc3.unesco.org/oopc/about/index.php

Orr, J.C., Fabry, V.J., Aumont, O., Bopp, L., Doney, S.C., Feely, R.A., Gnanadesikan, A., Gruber, N., Ishida, A., Joos, F., Key, R.M., Lindsay, K., Maier-Reimer, E., Matear, R., Monfray, P., Mouchet, A., Najjar, R.G., Plattner, G., Rodgers, K.B., Sabine, C.L., Sarmiento, J.L., Schlitzer, R., Slater, R.D., Totterdell, I.J., Weirig, M., Yamanaka, Y. and Yool, A. 2005. Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. Nature 437: 681-686.

Roberts JM, Wheeler AJ, Freiwald A (2006) Reefs of the deep: the biology and geology of cold-water coral ecosystems. Science 312:543-547

The Bali Action Plan (Advance unedited version). Available: http://unfccc.int/files/meetings/cop_13/application/pdf/cp_bali_action.pdf

The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report. http://www.ipcc.ch/ipccreports/ar4-syr.htm

The Ocean Acidification Network. Available: http://www.ocean-acidification.net/

4. Policy and legal issues related to marine areas beyond national jurisdiction

Overview

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 (see Part VII of UNCLOS. 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 governing marine areas beyond national jurisdiction, along with several other international conventions, regional seas agreements, and regional fishery management conventions as well as a number of non-binding global instruments (see the CBD report on the International Legal Regime of the High Seas and the Seabed beyond the Limits of National Jurisdiction and Options for Cooperation for the Establishment of Marine Protected Areas (MPAs) in Marine Areas beyond the Limits of National Jurisdiction, and 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).

The United Nations, through its relevant organizations has undertaken various initiatives to implement the provisions of UNCLOS and its Implementing Agreements related to the governance of marine areas beyond national jurisdiction, recently through: 1) 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; 2) UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea; 3) UN General Assembly (UNGA) resolutions.

The UNGA through resolution 59/24 on Oceans and the Law of the Sea (17 November 2004, paragraph 73), 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. 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 UN Ad Hoc Open-ended Working Group and also decided that the eighth meeting of the UN Open-Ended Informal Consultative Process on the Law of the Sea (the Consultative Process) would focus its discussions on "marine genetic resources."

In UNGA resolution (61/222, 2006), the UNGA identified five main areas for discussion at the second meeting of the Ad Hoc Open-ended Informal Working Group (to be held on April 28-May 2): 1) Environmental impacts of anthropogenic activities on marine biological diversity beyond areas of national jurisdiction: overfishing, destructive fishing practices, pollution from shipping and other sources, introduction of invasive alien

species, mineral exploration and exploitation, marine debris, marine scientific research, anthropogenic underwater noise, climate change, including mitigation techniques such as carbon sequestration and ocean fertilization; 2) cooperation and coordination among States as well as relevant intergovernmental organizations and bodies for the conservation and management of marine biological diversity beyond areas of national jurisdiction; 3) the role of area-based management tools; 4) genetic resources beyond areas of national jurisdiction; and 5) whether there is a governance or regulatory gap and if so, how it should be addressed.

The ongoing debate on the governance of marine areas beyond national jurisdiction in formal and informal fora has been contentious. The main divisive issue is the divergence of views regarding whether marine genetic resources (MGRs) in areas beyond national jurisdiction should be governed by the common heritage of mankind principle or high seas freedom provisions. There is also conflict as to whether resources should be used for the benefit of mankind as a whole or on a competitive basis (first come, first serve) and whether the exploitation of marine genetic resources in marine areas beyond national jurisdiction should be regulated. There is also the question of whether a new implementation agreement to UNCLOS is needed or whether existing legal instruments are sufficient. In a paper delivered to the International Tribunal on the Law of the Sea, Ms. Lori Ridgeway, Co-Chair of the United Nations Informal Consultative Process (ICP) on Oceans and the law of the Sea, describes some key aspects of the current policy debate regarding MGRs, drawing from international discussions that have taken place in the United Nations -- most recently in the 8th session of the Informal Consultative Process (ICP) on Oceans and the Law of the Sea, held in New York, June 25-29, 2007.

More recently, through the initiative of IUCN and other NGOs, over 50 experts in international marine policy, science, law and economics gathered to explore policy and regulatory options to improve oceans governance beyond areas of national jurisdiction with a focus on the protection and preservation of the marine environment and marine biological diversity, in the IUCN Workshop on High Seas Governance for the 21st Century held in New York City on October 17-19, 2007.

Key sources attached to this document[11]

- Convention on Biological Diversity (CBD). 2005. The International Legal Regime of the High Seas and the Seabed beyond the Limits of National Jurisdiction and Options for Cooperation for the Establishment of Marine Protected Areas (MPAs) in Marine Areas beyond the Limits of National Jurisdiction. Note by the Executive Secretary. Ad-Hoc Open-Ended Working Group on Protected Areas. First Meeting, Montecatini, Italy, 13-17 June 2005. 28 April 2005. UNEP/CBD/WG-PA/1/INF/2. Available: http://www.biodiv.org/doc/meetings/pa/pawg-01/information/pawg-01-inf-02-en.doc

[11] The sources noted as "attached to this volume" are on the Global Forum website and maybe downloaded by participants through links on pages 23-24.

- United Nations General Assembly (UNGA). 2006. Report of 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. Transmittal letter dated 9 March 2006 from the Co-Chairpersons of the Working Group to the President of the General Assembly. 20 March 2006. Available: http://daccess-ods.un.org/access.nsf/Get?Open&DS=A/61/65&Lang=E

- United Nations General Assembly (UNGA). 2007. Report on the work of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea at its eighth meeting. Letter dated 30 July 2007 from the Co-Chairpersons of the Consultative Process addressed to the President of the General Assembly. A/62/169. Available: http://daccessdds.un.org/doc/UNDOC/GEN/N07/443/75/PDF/N0744375.pdf?OpenElement.

- Ridgeway, L. 2007. Marine Genetic Resources: Outcomes of the United Nations Informal Consultation Process (ICP) and Policy Implications of the Debate. ITLOS Symposium on Marine Genetic Resources, forthcoming publication, in press.

- IUCN Workshop on High Seas Governance for the 21st Century, New York, October 17-19, 2007. Co-Chairs' Summary Report. December 2007. Available: http://www.iucn.org/themes/marine/pubs/pubs.htm

- Burnett, Douglas R. Legal Jurisdiction over International Submarine Cables**.**

Other important documents

CBD. 2005. The International Legal Regime of the High Seas and the Seabed Beyond National Jurisdiction. CBD Technical Report No. 19. http://www.cbd.int/doc/publications/cbd-ts-19.pdf

United Nations General Assembly (UNGA). 2005. Report of the Secretary General. Addendum. Oceans and the Law of the Sea. 15 July 2005. A/60/63Add1. Available: http://daccessdds.un.org/doc/UNDOC/GEN/N05/425/11/PDF/N0542511.pdf?OpenElement.

United Nations General Assembly (UNGA). 2007. Brazil, Canada, Cape Verde, Fiji, Finland, Guatemala, Iceland, Indonesia, Malaysia, Mexico, Monaco, Norway, Philippines, Portugal, Slovenia, Sweden and United States of America: draft resolution. 4 December 2007. A/62/L.27. Available: http://daccessdds.un.org/doc/UNDOC/LTD/N07/625/18/PDF/N0762518.pdf?OpenElement.

United Nations General Assembly (UNGA). 2007. Resolution 62/215. 22 December

2007.

United Nations General Assembly (UNGA). 2007. Report of the Secretary General Addendum. Oceans and the Law of the Sea. 10 September 2007. A/62/66Add.2. Available: http://daccessdds.un.org/doc/UNDOC/GEN/N07/500/06/PDF/N0750006.pdf?OpenElement

5. Information on progress achieved in meeting the international goals on oceans, coasts, and small island developing states from the 2002 World Summit on Sustainable Development

Report on *Meeting the Commitments on Oceans, Coasts, and Small Island Developing States Made at the 2002 World Summit on Sustainable Development: How Well Are We Doing?* Global Forum on Oceans, Coasts, and Islands (2006)

Global Forum Working Group Co-chairs Report from the Third Global Conference

6. Sources attached to this volume

The sources noted as "attached to this volume" are on the Global Forum website and maybe downloaded by participants through links on pages 23-24.

Burnett, Douglas R. Legal Jurisdiction over International Submarine Cables**.**

Convention on Biological Diversity (CBD). 2005. The International Legal Regime of the High Seas and the Seabed beyond the Limits of National Jurisdiction and Options for Cooperation for the Establishment of Marine Protected Areas (MPAs) in Marine Areas beyond the Limits of National Jurisdiction. Note by the Executive Secretary. Ad-Hoc Open-Ended Working Group on Protected Areas. First Meeting, Montecatini, Italy, 13-17 June 2005. 28 April 2005. UNEP/CBD/WG-PA/1/INF/2.

Convention on Biological Diversity (CBD). 2006. Scientific Information on Status and Trends of, and Threats to, Deep Seabed Genetic Resources beyond National Jurisdiction. Note by the Executive Secretary pursuant to SBSTTA recommendation XI/8. 10 February 2006.

German Advisory Council on Global Change. 2006. The Future Oceans – Warming Up, Rising High, Turning Sour. Special Report. Berlin.

IUCN Workshop on High Seas Governance for the 21st Century, New York, October 17-19, 2007. Co-Chairs' Summary Report. December 2007.

Observations, some current conditions and evaluations on climate change and marine areas beyond national jurisdiction, Dr. Gunnar Kullenberg, former Executive Secretary, Intergovernmental Oceanographic Commission.

Ridgeway, L. 2007. Marine Genetic Resources: Outcomes of the United Nations Informal Consultation Process (ICP) and Policy Implications of the Debate. IFLOS Symposium on Marine Genetic Resources, Forthcoming publication, in press.

United Nations General Assembly (UNGA). 2006. Report of 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. Transmittal letter dated 9 March 2006 from the Co-Chairpersons of the Working Group to the President of the General Assembly. 20 March 2006.

United Nations General Assembly (UNGA). 2007. Report on the work of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea at its eighth meeting. Letter dated 30 July 2007 from the Co-Chairpersons of the Consultative Process addressed to the President of the General Assembly. A/62/169.

UNU-IAS. 2006. Implementing the Ecosystem Approach in Open Ocean and Deep Sea Environments - An Analysis of Stakeholders, their Interests and Existing Approaches. UNU-IAS Report.

World Climate Research Programme Briefing to IOC 2007.