Report to the Ninth Meeting of the Conference of the Parties of the Convention on Biological Diversity, 19-30 May 2008, Bonn, Germany

Policy Brief on Marine Biodiversity and Networks of Marine Protected Areas

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Global Forum on Oceans, Coasts, and Islands – Strategic Oceans Planning to 2016

The Global Forum on Oceans, Coasts, and Islands has undertaken a strategic planning effort for the period 2006-2016 to develop policy recommendations for specific next steps needed to advance the global oceans agenda aimed at governments, UN agencies, NGOs, industry, and scientific groups. To this effect, Working Groups have been organized around 12 major topic areas related to the global oceans commitments made at the 2002 World Summit on Sustainable Development and to emerging issues facing the global oceans community.

The Working Groups have been organized and coordinated by the Global Forum Secretariat, under the direction of Dr. Biliana Cicin-Sain, Co-Chair and Head of Secretariat, Global Forum on Oceans, Coasts, and Islands, and involving the following staff from the Gerard J. Mangone Center for Marine Policy, University of Delaware: Miriam Balgos, Kateryna Wowk, Caitlin Snyder, Shelby Hockenberry, and Kathleen McCole.

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Global Forum on Oceans, Coasts, and Islands

Working Group on Marine Biodiversity and Networks of Marine Protected Areas

Policy Brief:
Marine Biodiversity and Networks of Marine Protected Areas

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Submitted to the Ninth Meeting of the Conference of the Parties
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Foreword

Working Group on Marine Biodiversity and Networks of Marine Protected Areas

This report is being submitted to the Ninth Meeting of the Conference of the Parties to the Convention on Biological Diversity, held in Bonn, Germany from 19 to 30 May 2008.

Halting the loss of marine and coastal biodiversity is an important component of maintaining ocean and coastal ecosystem function. The 2002 WSSD established the following goals:

- To achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth.

- Develop and facilitate the use of diverse approaches and tools, including the ecosystem approach, the elimination of destructive fishing practices, and the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012.

Considering progress on the achievement of the WSSD biodiversity and marine protected area goals, it seems that in this area tangible progress has been made since 2002. Important initiatives are underway at both national and regional levels, and in the national reports to the Convention on Biological Diversity (CBD), a large proportion of nations reporting note that they have designated marine protected areas (MPAs) and/or have plans to improve existing MPAs. Implementation of the WSSD biodiversity and MPA goals benefits from the connection to an international convention— the Convention on Biological Diversity— and its Secretariat, which provide a well organized structure and process for advancing biodiversity around the world. In this area, too, there is generally good monitoring and regular reporting of progress on biodiversity conservation through such means as the national reports, the conference of the parties, and the scientific meetings. This is not the case with regard to many of the other WSSD goals.

Many challenges still remain, however, in halting biodiversity loss and in the establishment of networks of marine protected areas, including, insufficient funding, inadequate awareness about the value of the resources, lack of political will and lack of shared long-term vision among stakeholders. It is also important to embed the creation of MPAs within broader governance systems of integrated ocean and coastal management. These considerations are essential because the effectiveness of MPAs is not only influenced by the management of activities within the designated areas, but also human activities that are sometimes far removed from the protected area.

The issue of high seas and deep seabed biodiversity will continue to be a key issue in the coming years. There is an important opportunity to build momentum towards addressing this issue in a collaborative and inclusive way in the near term. Many

national governments, NGOs, as well as intergovernmental organizations are poised to move forward and take significant steps towards conserving and maintaining biodiversity in marine areas beyond national jurisdiction. Finally, it is important to underline that the achievement of the biodiversity conservation goals is directly tied to the efforts to meet the goals related to fisheries as well as the goals on integrated ocean and coastal management and on ecosystem management. These goals should be considered mutually supporting and, to the extent possible, they should be considered as parts of a whole.

Discussions Held on Marine Biodiversity and Networks of Marine Protected Areas at the Fourth Global Conference on Oceans, Coasts, and Islands, April 7-11, 2008, Hanoi, Vietnam

1. Examined, in particular, the interrelationship between biodiversity preservation and climate change, and the policy implications that are raised by projected impacts.

2. Considered the detailed priority steps articulated in the Policy Brief on two major areas:

- Improving the mechanisms for considering progress toward the 2010/2012 targets, including improving the conduct of periodic reporting and selection of indicators (a theme that runs through a number of the other policy briefs)

- Accelerating efforts to reduce the loss of marine biodiversity at national, regional, and global levels

3. Considered additional recommendations made in the Policy Brief for possibly useful roles that could be played by the Global Forum, e.g., the Global Forum could concentrate on:

- bringing together national economic planners, tourism planners and other leaders from different oceans sectors to exchange information on how to create economic growth while fostering marine biodiversity conservation, and in so doing raise the need for integrated marine and coastal management planning, as well as the work of the Regional Seas conventions

- highlighting successful initiatives which demonstrate the value of marine biodiversity conservation through, for example:

    - MPAs that have brought local and national benefits in terms of alternative livelihoods and strengthening economic growth, through, for example, fisheries and tourism

    - Protection of vulnerable coastal communities and thus adaptation to climate change

- promoting support for valuation of marine biodiversity and ecosystem services

- facilitating efforts to build up a global picture of existing MPA initiatives (see the related discussions of the SIDS Working Group) and encourage sharing of information and expertise

- exploring the possibility of a Friends of the Jakarta Mandate Group

- promoting partnership work on key issues such as coral reef and mangrove monitoring and management through organizations such as Reef Check/GCMRN.

- encouraging the development of a reporting mechanism for CBD and other international bodies that helps Parties to contribute data on marine biodiversity trends and MPA status to the global centers and databases (e.g. WDPA, WCPA-Marine, ReefBase, GCRMN) for analysis, and that ensures good dissemination of the results and benefits to all those involved from provision of better data on trends

- supporting opportunities and funding for activities that increase the exchange of information and lessons learned among the marine conservation community so that progress toward the 2012 target accelerates.

The Global Forum Secretariat is indebted to Sue Wells, UK, for her work in preparing the policy brief. Many thanks are due to Dr. Jihyun Lee, Environmental Affairs Office for Marine and Coastal Biodiversity, Secretariat of the Convention on Biological Diversity, for leading the Working Group with great energy and efficiency, and to the many other contributions made by Working Group leaders and members to the report. We also are very grateful to the following individuals who provided specific input and comment on the text: Chris Tompkins (UK, formerly with DEFRA), Gregor Hodgson (ReefCheck), Clive Wilkinson (GCRMN), Yvonne Sadovy (IUCN/SSC), Nicholas Pilcher (IUCN/SSC Marine Turtle Specialist Group), James Hardcastle and Alan White (TNC), Colleen Corrigan (UNEP-WCMC), and Kristian Teleki (ICRAN).

Biliana Cicin-Sain
Global Forum on Oceans, Coasts, and Islands

POLICY BRIEF:
MARINE BIODIVERSITY AND NETWORKS OF MARINE PROTECTED AREAS

1. Introduction

In April 2002, the Conference of the Parties to the Convention on Biological Diversity (CBD) committed themselves to **achieving by 2010 a significant reduction in the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth.** This target was subsequently endorsed by the world's political leaders at the World Summit on Sustainable Development (WSSD) in 2002 and the United Nations General Assembly (UNGA) and was incorporated as a new target under the Millennium Development Goals.

The case for conserving marine biodiversity is compelling. It is essential to human life in numerous ways – providing food and essential compounds for drugs and technology; tourism attractions and recreational activities, and protection from storms and shore erosion. The potential global value of marine ecosystems is vast, and may well outweigh terrestrial equivalents[1]. Marine fish and invertebrates are the last source of wild food on the planet, providing over 2.6 billion people with at least 20% of their average per capita protein intake[2]. Globally, almost US$ 10 billion is spent on coral reef tourism every year; potential fishing benefits from healthy coral reefs are estimated at US$ 5.7 billion annually[3]. Marine species such as cone shells, sharks and horseshoe crabs have the potential to play vital roles in the development of treatments for cancer, muscle diseases, and chronic pain[4].

The world's population is gravitating towards the oceans, adding to pressures on an already stressed marine resource base. 70% of cities with populations over 8 million are now located on the coast. 90% of sewage is simply dumped into the sea in developing countries, and half the world's coastal wetlands have disappeared. 75% of global fisheries are fully utilised or over-fished, and 60% of coral reefs are threatened, along with the benefits to livelihoods, biodiversity, coastal protection and medical advances.

Marine protected areas (MPAs) are key tools for halting marine biodiversity loss and achieving the 2010 biodiversity target. Ranging in kind from strict protection to multiple-use, they provide an effective mechanism to combine long term conservation of marine resources with economic development and food security, providing opportunities for coastal communities to generating income, creating jobs, and providing for recreation and tourism. They provide a model of the value of the ecosystem approach, and will be a key tool in future adaptation strategies to address climate change.

Article 8 of the CBD requires Parties to establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity. In 2002, the WSSD called for the **"establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012".** Subsequently, at the 7th

[1] The following global estimated values of marine ecosystems are often quoted: US$24,000ha/yr for estuaries, US$20,000 ha/yr for seagrass/algal beds, US$10,000 for mangroves and tidal marshes, and US$6,000 for coral reefs (Costanza et al. 1997. The value of the world's ecosystem services and natural capital. *Nature* 387: 253–260.). These figures are often disputed but nevertheless give some idea of the economic importance of marine ecosystems..

[2] Nellemann, C., Hain, S., and Alder, J. (Eds). 2008. *In Dead Water – merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds.* UNEP, GRID-Arendal, Norway, www.grida.no

[3] Mulongoy, K.J. and S.B. Gidda (2008). *The Value of Nature: Ecological, Economic, Cultural and Social Benefits of Protected Areas.* Secretariat of the Convention on Biological Diversity, Montreal, 30 pages.

[4] Chivian, E. and Bernstein, A. (eds). 2008. Sustaining Life: How Human Health Depends on Biodiversity. Oxford University Press

meeting of the Conference of the Parties to the CBD (COP7) in 2004, Parties committed to the target in the WSSD Plan of Implementation.

Global sustainable development and poverty reduction over the next decade and beyond requires healthier oceans and stable coastal communities, both of which depend on reversing the declining trends in marine biodiversity. This Policy Brief provides a preliminary review of the progress made at global, regional, and/or national levels in meeting the global target for biodiversity in relation to the marine environment, and the targets for representative networks of MPAs. It provides a comparison with the review undertaken by the Global Forum in 2006[5], summarises the main problems and obstacles to achieving the targets, and identifies priority policy issues and recommendations for addressing these. A draft was presented at the 4th Global Conference on Oceans, Coasts, and Islands (7-11 April 2008, Hanoi, Vietnam) and this revision incorporates the outcomes of some of the discussions held there. The Brief will also contribute to discussions at the World Ocean Conference (11-15 May 2009, Manado, Indonesia), and to the in-depth review of the CBD Programme of Work (POW) on marine and coastal biological diversity that will be undertaken at COP10 in 2010.
The Brief was prepared using information from a number of sources including: the review and synthesis[6] of the 3rd National Reports to the CBD; the information papers for and the report of the 13th meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 13); the results of a survey circulated to the members of the Working Group on Marine Biodiversity and Networks of Marine Protected Areas by the Global Forum Secretariat; and a review of progress made in establishing MPA networks that has been undertaken by the UNEP World Conservation Monitoring Centre (UNEP-WCMC) and the UNEP Regional Seas Programme (UNEP RSP)[7].

2. Preliminary Assessment of progress in achieving 2010 and 2012 targets

At the CBD COP7, an elaborated POW on marine and coastal biological diversity was adopted (Annex 1 to Decision VII/50 that is aimed at assisting Parties to implement the Jakarta Mandate. It identifies key operational objectives and priority activities within five programme elements, namely: (i) implementation of integrated marine and coastal area management; (ii) marine and coastal living resources; (iii) marine and coastal protected areas; (iv) mariculture; and (v) invasive alien species. This Brief is concerned with the elements relating to marine and coastal living resources (excluding the specific topic of fisheries which is covered elsewhere), MPAs and invasive alien species. The CBD's Programme of Work on Protected Areas (POWPA) is also relevant and progress made towards some of the activities defined under this is also reviewed.

2.1. Marine Biodiversity

For both terrestrial and marine biodiversity, assessing global progress towards the 2010 target is not easy given the paucity of consistent and repeated measures, although at national and regional scales there are more datasets[8]. Since the target is ''a significant reduction in the current rate of loss of biological diversity'' the *rate* of loss must be measured, which means that at least three

[5] Cicin-Sain, B., Vandeweerd, V., Bernal, P.A., Williams, L.C. and Balgos, M.C. 2006. *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?* Co-Chairs' Report—Volume 1, Third Global Conference on Oceans, Coasts and Islands, June 2006.

[6] Refer to documents UNEP/CBD/WG-RI/2/INF/1, UNEP/CBD/WG-RI/2/INF/1/Add.1, UNEP/CBD/WG-RI/2/INF/1/Add.2, and UNEP/CBD/WG-RI/2/INF/1/Add.3. Note that 134 Parties had submitted their 3rd national reports as of January 2008, but only 123 reports were loaded in the National Reports Analyzer and were used in the analysis for this Policy Brief (see http://www.cbd.int/reports/analyzer.shtml)

[7] *Establishing national and regional networks of MPAs – a review of progress with lessons learned*. Draft report to UNEP-WCMC and UNEP Regional Seas Programme, 2008.

[8] Biodiversity. Chap 4 in Millennium Ecosystem Assessment

estimates need to be available prior to 2010; measures at only two different points in time will show absolute change but not changes in rate. A further complication is that, in highly degraded ecosystems, the rate of loss may be reduced simply because any further loss has to be at a slower rate, a situation that may be occurring with some coral reefs and mangroves. The choice of baseline against which change is measured is thus important - a slight increase over a short period of time could be interpreted as a reduction in rate, whereas if the same increase is compared with a historically longer and greater decline it may be evident that there has been no overall reduction in biodiversity loss.

Assessing global progress is particularly difficult for marine biodiversity as, in addition to the lack of knowledge on current rates of loss, we have no clear baseline starting point. We do not yet understand the full scope of marine biodiversity, with thousands of species still undescribed, many marine ecosystems and habitats poorly understood, and knowledge of marine genetic resources still in its infancy. We do not even know how many marine species have scientific names, with estimates ranging between 300,000 and one million. The estimated total of existing marine species is equally vague, ranging between 500,000 and 100 million, with vast numbers of small organisms and prokaryotes awaiting description[9]. What has been known for many years is the enormous diversity of the marine environment, with 32 of the 33 animal phyla being found in the sea, and 15 of these being exclusively marine.

Three of the '2010 Indicators' proposed by the CBD[10] to help assess progress towards the targets address biodiversity status are discussed in the following sections:

- Trends in extent of selected biomes, ecosystems and habitats
- Trends in abundance and distribution of selected species
- Change in status of threatened species

2.1.1. Trends in extent of selected biomes, ecosystems and habitats

For some habitats and ecosystems, existing assessment and monitoring programmes are providing preliminary data on progress towards the 2010 target, but for many there is no information. Although this indicator specifies trends in 'extent', it is equally important that trends in 'health' or 'quality' of an ecosystem are measured. Ecosystems, such as pelagic waters and abyssal plains, may change little in extent, but their 'health' in terms of the species that live within them is vitally important. Biomes, ecosystems and habitats for which data are available at the global level include tropical coral reefs, mangroves, sea grass beds, estuaries and the deep sea and these are reviewed below.

1. Tropical Coral Reefs

The CBD's POW puts particular emphasis on coral reefs given their extreme vulnerability. Tropical coral reefs are comparatively well monitored and mapped and, unlike many ecosystems, some quantitative assessments can be made. This is largely a result of the Global Coral Reef Monitoring Network (GCRMN) which was established in 1995, as part of the International Coral Reef Initiative (ICRI), and its 17 regional networks. Global status reports are produced on a regular basis, with the next one due in 2008[11]. A parallel monitoring network, Reef Check was established in 2006 to mobilize volunteer divers and communities to monitor of reefs and raise awareness; it runs the only standard volunteer monitoring program with teams in 93 countries and territories. Data from both the GCRMN and Reef Check are sent to the global coral reef database, ReefBase, established at the WorldFish Center in Penang Malaysia. An additional assessment tool is the Millennium

[9] UNEP (2007) Deep-Sea Biodiversity and Ecosystems: A scoping report on their socio-economy, management and governance. UNEP-WCMC Biodiversity Series No 28 (www.unep-wcmc.org/resources/publications/UNEP_WCMC_bio_series); UNEP Regional Seas Reports and Studies N° 184 (www.unep.org/regionalseas/Publications/Reports/Series_Reports/Reports_and_Studies)

[10] http://www.twentyten.net/target.aspx

[11] Wilkinson, C. (ed). 2004. *Status of Coral Reefs of the World: 2004.* Australian Institute of Marine Science, Townsville, Queensland.

Coral Reef Mapping Project, a product of the Institute for Marine Remote Sensing at the University of South Florida and funded by the Oceanography Program of the National Aeronautics and Space Administration (NASA); it is planning to release a worldwide inventory of coral reefs using high-resolution satellite imagery in July 2008.

There are an estimated 28.4 million ha of coral reef. The summary of the GCRMN 2004 assessment, based on the opinions of the 240 authors, is that[12]:

- About 20% of the world's reefs have been effectively destroyed and show no immediate prospects of recovery;
- About 16% of the world's reefs were seriously damaged by coral bleaching in 1998, but of these about 40% have either recovered or are recovering well;
- About 24% of the remaining reefs are under imminent risk of collapse through human pressures; and
- A further 26% are under a longer-term threat of collapse.

These conclusions are supported by trends identified by ReefCheck[13], and by the regional GCRMN reports for the tsunami-affected countries[14] and Caribbean[15]. In the Caribbean, abnormally high sea temperatures caused severe coral mortality as a result of bleaching or subsequent infections by disease. In some places, particularly around the Lesser Antilles, coral cover has declined by 50% and populations of key reef-building species by 73%. Many corals were still bleached into 2006 and in a few places they were still bleached in 2007 or were succumbing to disease. The report predicts that coral bleaching will occur more frequently by 2030 and is likely to be an annual event by 2100.

A further tool is the *Reefs at Risk* assessment of threats to coral reefs, produced by a partnership lead by the World Resources Institute (WRI) and the International Coral Reef Action Network (ICRAN). The 1998 version showed that almost 60% of the world reefs were threatened by human activities, with 35% of reefs threatened by overexploitation, and over 30% by coastal development. More detailed regional analyses were undertaken for the Caribbean (2004) and Southeast Asia (2002) and showed similar trends[16]. A revised global assessment will be released in 2008.

Despite this gloomy situation, there is much activity underway to attempt to reverse these trends as indicated by the 3rd national reports to the CBD as shown in Table 1; it should be noted that this table considerably under-estimates the initiatives being undertaken; many countries have failed to report their activities to the CBD. A more complete review is available in Wilkinson (2006)[12].

[12] Wilkinson, C. 2006. Status of coral reefs of the world: summary of threats and remedial action. Chap 1. In: Cote, I.M. and Reynolds, J.D. (Eds). *Coral Reef Conservation.* Cambridge University Press, Cambridge, UK.

[13] Hodgson, G. 1999. A global assessment of human effects on coral reefs. *Mar. Poll. Bull*. 38(5) 345-355.
Hodgson, G. and J. Liebeler. 2002. The global coral reef crisis – trends and solutions. Reef Check, Institute of the Environment, University of California, Los Angeles.77 pp

[14] Wilkinson, C., Souter, D.and Goldberg, J. 2005. Status of Coral Reefs in Tsunami Affected Countries: 2005. Australian Institute of Marine Science, Townsville, Queensland.

[15] Wilkinson, C. and Souter, D. 2005. Status of Caribbean Coral Reefs after Bleaching and Hurricanes in 2005. Australian Institute of Marine Science, Townsville, Queensland.

[16] http://www.wri.org/project/reefs-at-risk

Table 1. Number of Parties reporting coral reef progress according to the 3rd national reports to the CBD, as of January 2008. Total number of reporting countries = 123 of which c. 80 have reefs.

Coral Reef Intervention	% reporting countries with reefs (no. countries)	Examples of national efforts
Integrated coastal management and protected areas	43 (34)	**Brazil**: atlas of coral reefs; initiatives taken to establish a Coral Reef Protection Network. **St Lucia:** 26 marine reserves established and being managed by Soufriere Marine Management Authority. **Viet Nam** efforts on coral reef protection closely linked to integrated coastal management projects. **Philippines**: Focus on Tubbataha Reef National Marine Park and World Heritage Site.
Ecological assessment and monitoring of reefs	54 (43)	**Brazil:** baseline for national monitoring program linked to the GCRMN established; **Japan:** International coral reef research and monitoring centre set up in 2000, responsible for long-term national coral monitoring program, and 5-yearly survey of coral coverage.
Socio-economic assessments and monitoring of communities and stakeholders	41 (33)	**Australia:** undertaken as part of the Great Barrier Reef Marine Park Authority (GBRMPA)'s Climate Change Response Program. **Indonesia**: undertaken in 10 provinces through COREMAP (Coral Reef Rehabilitation and Management Program);
Stakeholder partnerships, community participation programmes and public education campaigns in place	50 (40)	
Initiatives to identify and implement additional and alternative livelihoods for people who directly depend on coral reef services	28 (22)	**India**: underway through the "Techno-socio-economic program" with CORDIO (Coral Reef Degradation in the Indian Ocean Programme) **Indonesia**: inter-ministerial collaborative efforts underway.
Efforts on restoration and rehabilitation of degraded coral reef habitats	34 (27)	**Malaysia**: State Committee for inland and coastal water assessed the need for coral rehabilitation including artificial reef development **Japan**: launched a coral reef rehabilitation project in 2005; published a manual for reef restoration and remediation.
Development of an early warning system for coral bleaching as well as a rapid response capability to document coral bleaching and mortality	15 (12)	**Australia**: the GBRMPA has established a coral bleaching response that includes an early warning system and rapid response capability, and involves building partnerships with various stakeholders; the GBRMPA Climate Change Response Program includes identification and implementation of adaptation strategies. **Brazil**: project on global climate change and coral bleaching **St Lucia**: monitoring of coral bleaching underway

2. Mangroves

Global mangrove cover in 2005 was estimated at 15.2 million ha, with the largest areas in Asia and Africa followed by North and Central America. Twenty percent, or 3.6 million ha have been lost from the 18.8 million covering the planet in 1980. The rate of net loss appears to have slowed recently but is still very high: from about 185,000 ha a year in the 1980s to about 102,000 ha a year over the period 2000-2005[17]. The major causes of mangrove decline are conversion to aquaculture and agriculture, and urban, residential and tourism development.

There has been much greater attention to this ecosystem since the 2004 tsunami, which raised awareness of the value of mangroves, particularly in terms of shore protection. In 2007 FAO identified 2900 national and subnational data sets on the extent of mangrove forests[17]. For example, Malaysia has completed an assessment and monitoring of mangrove ecosystems using remote sensing and geographic information system (GIS), and launched a national mangrove replanting programme. Extensive replanting programmes have been initiated particularly in South-East Asia, which should lead ultimately to increased extent, and reduction in the rate of loss, but not necessarily to the full biodiversity complement compared with original mangroves forests. The Mangroves for the Future initiative, led by IUCN (International Union for Conservation of Nature) in collaboration with a range of partners, is using mangroves as a flagship to promote sound coastal management in the tsunami affected countries[18].

3. Sea grass beds

Seagrasses cover about 0.1–0.2% of the global ocean. In 2003, UNEP-WCMC produced the *World Atlas of Seagrasses* with an associated database that is being continually updated[19]. At present there are no global assessments showing trends in the extent of this ecosystem but in the future data should become available through various the monitoring programmes including SeaGrassNet (primarily for managers and professionals; a global protocol is being developed that involves quarterly data collection) and Seagrass Watch (a monitoring programme for communities and volunteers)[20]. Small scale studies have shown that seagrass beds are undergoing significant declines both in extent and in health, and these losses are expected to accelerate, particularly in South-East Asia and the Caribbean, as human pressure on the coastal zone grows[21].

4. Estuaries

Worldwide, there are about 1,200 major estuaries covering some 500,000 km^2. Some idea of their status can be obtained from a study[22] of the magnitude and causes of ecological change in 12 estuaries and coastal seas[23] in Europe, North America, and Australia. This traced changes in important species, habitats, water quality parameters and species invasions from the onset of human settlement to the present day, using palaeontological, archaeological, historical, and ecological records. The primary cause of estuarine damage was human exploitation which caused 95% of species depletions and 96% of extinctions, often in combination with habitat destruction. Most mammals, birds and reptiles in estuaries were depleted by 1900 and had declined further by 1950. Among fish, salmon and sturgeon were depleted first, followed by tuna and sharks, cod and halibut, and herring and sardines. Oysters were the first invertebrate resource to degrade because of their value and accessibility as well as destructive harvesting methods. Human

[17] FAO 2007. *The World's Mangroves 1980-2005.* FAO Forestry Paper 153, FAO, Rome.
[18] www.mangrovesforthefuture.org
[19] Green, E.R. and Short, F.T. 2003. *World Atlas of Seagrasses*. UNEP-WCMC

[20] http://www.seagrassnet.org
[21] Duarte, C.M. 2002. The future of seagrass meadows. *Environmental Conservation* 29: 192-206
[22] Lotze,H.K., Lenihan, H.S., Bourque, B.J., Bradbury, R.H., Cooke, R.G., Kay, M.C., Kidwell, S.M., Kirby, M.X., Peterson, C.H., Jackson, B.C. 2006. Depletion, degradation and recovery potential of estuaries and coastal seas. *Science* 23 (312) 5781:1806 - 1809
[23] Massachusetts Bay, Delaware Bay, Chesapeake Bay, Pamlico Sound, Galveston Bay, Francisco Bay, Western Baltic Sea, Wadden Sea, Northern Adriatic Sea, Southern Gulf of St. Lawrence, Outer Bay of Fundy, and Moreton Bay

impacts also destroyed over 65% of seagrass and wetland habitat, degraded water quality, and accelerated species invasions.

The same study found that some species, notably birds and seals, were recovering, with 78% of recoveries due to reduction of at least two of three identified human activities: resource exploitation, habitat destruction, and pollution. Conservation efforts have led to partial recovery of upper trophic levels but have so far failed to restore former ecosystem structure and function. The trends suggest that estuaries may have passed the low point and are on the path to recovery in developed countries but that in developing countries, population growth may further increase degradation. In the coming years invasive species and climate change may play a larger role in stressing estuarine resources.

5. Deep Sea

Rapid progress is being made in our understanding of the deep seas and seabed[24] and there is now a growing body of information on some of the key ecosystems. This will provide an important baseline for developing long-term monitoring programmes.

- *Seamounts*: The Census of Marine Life project (CenSeam) is collating information on this ecosystem. About 100,000 seamounts over 1 km high have been identified, as well as many smaller ones. At least 70% are located in marine areas beyond national jurisdiction. Seamounts are of particular conservation concern as they are often linked with cold water coral reefs and hydrothermal vents, attract predators and have high species biodiversity (c. 800 fish species described), with an estimated 20% endemism. Many seamount communities have been depleted by overfishing.
- *Cold water coral reefs:* these cover an estimated 284,300 km^2, mainly on the edge of continental shelves or on seamounts; they grow at about one tenth of the speed of tropical reefs; corals are less diverse but overall diversity approaches that of coral reefs.
- *Hydrothermal vents*: these are found along all active mid-ocean ridges and back-arc spreading centers; the Inter Ridge Hydrothermal Vent Database lists 212 separate known vent sites and there are likely to be more. Over 470 species have been recorded from hydrothermal vents, of which 91% are endemic. Micro-organisms predominate and thousands of low-abundance populations account for most of the observed diversity between phyla (molluscs (29%), crustaceans (33%), and polychaetes (17%)). Biogeographic differentiation of the vents is not yet understood.
- *Sponge reefs*: these are constructed by glass sponges; they are slow-growing; still relatively unknown and the only known sites are in Canadian waters; associated communities are very diverse.
- *Cold seeps* (oil and gas seeps): These are found at depths of between <15 m to >7,400 m in all oceans in except the Polar regions, and only a small fraction of them have been located and mapped. Cold seep communities produce organic carbon in large quantities through microbial chemosynthesis, and this contributes to the high biomass present and the large size of the fauna. These communities are dominated by symbiont-bearing tubeworms, mussels, and clams, often belonging to genera occurring also at hydrothermal vents.[25]

The recent synthesis prepared by the CBD[26] demonstrated that there is clear evidence of detrimental human impact on these habitats in the form of destructive fishing practices, such as bottom trawling, as well as climate change, pollution, mining, research, bioprospecting, and carbon sequestration. Conservation action is therefore needed on the basis of the precautionary approach, even if though scientific understanding is still imperfect.

[24] UNEP (2007) Deep-Sea Biodiversity and Ecosystems: A scoping report on their socio-economy, management and governance. UNEP-WCMC Biodiversity Series No 28 (www.unep-wcmc.org/resources/publications/UNEP_WCMC_bio_series); UNEP Regional Seas Reports and Studies N° 184 (www.unep.org/regionalseas/Publications/Reports/Series_Reports/Reports_and_Studies)

[25] UNEP/CBD/SBSTTA/13/INF/13

[26] UNEP/CBD/SBSTTA/13/INF/11

Urgent research efforts are needed to identify the potential impacts of ocean acidification, which is a major threat, particularly to cold water corals.

2.1.2. Trends in abundance and distribution of selected species

Data on trends in abundance and distribution of marine species are very limited. The ''shifting baseline syndrome'' first described in the context of fisheries (i.e., that every new generation accepts as a baseline the population size and species composition present when they started measurements), is a particular issue in the marine environment[27], given the very recent ability to measure marine biodiversity and the lack of knowledge about pristine communities before human activities began to have an impact. Projected changes due to climate change also mean that it is very urgent to establish current distributions of marine species. There is already evidence that warm water species of fish, benthic and intertidal organisms and plankton are moving polewards in both hemispheres: for example, warm water copepods (crustaceans) have moved northwards by about 1000 km within the last 40-50 years in the North-East Atlantic[28].

A baseline for marine biodiversity is being established through the Census of Marine Life (CoML)[29], a 10-year programme that started in 2000 and involves over 2000 researchers from over 80 countries. It will release its first comprehensive report in 2010. It comprises a number of interlinked programmes including zooplankton (CmarZ), marine microbes, abyssal marine life, seamounts, coral reefs (CReefs), and shore areas (Natural Geography In Shore Areas (NaGISA). Data gathered through these programmes are deposited in the global database of the Ocean Biogeographical Information System (OBIS)[30]. The associated World Register of Marine Species (WoRMS) allows for the listing all published names of marine species; 100,000 names had been listed by the end of 2007 and it is intended that 200,000 should be listed by the end of 2008.

For a few well-studied species, primarily the larger, more 'charismatic' species (seabirds, turtles, cetaceans, large fish), long-term population data are available, and some examples are given below.

Marine turtles: Data on marine turtles are compiled through a number of initiatives, and databases have been established at UNEP WCMC, the Archie Carr Sea Turtle Research Center in Florida, the Pacific Regional Environment Programme, and the IOSEA Secretariat in Bangkok. A recent world wide review of over 80 key nesting stocks of the hawksbill *Eretmochelys imbricata* showed that while many populations are stable or even increasing, the majority remain far below historical levels.

Cetaceans: Whale populations are monitored by the Scientific Committee of the International Whaling Commission. Three species show increasing trends for some populations (gray whale *Eschrichtius robustus* - eastern north Pacific; bowhead whale *Balaena mysticetus* - Bering-Chukchi-Beaufort Seas stock; humpback whale *Megaptera novaeangliae* - western north Atlantic and Southern Hemisphere south of 60°S in summer), reflecting recovery following a period of heavy harvesting pressure. However, these are very small changes in the context of major overall declines of whale species since the onset of commercial whaling.[31]

Seabirds: the Global Seabird Programme, which is co-ordinated on behalf of the BirdLife International Partnership, by the Royal Society for the Protection of Birds (RSPB), is documenting trends in seabird populations; many species, such as albatross, are showing significant declines.

[27] www.shiftingbaselines.org; Jackson et al. 200. Historical overfishing and the recent collapse of marine ecosystems. *Science* 293 (5530): 629 - 637

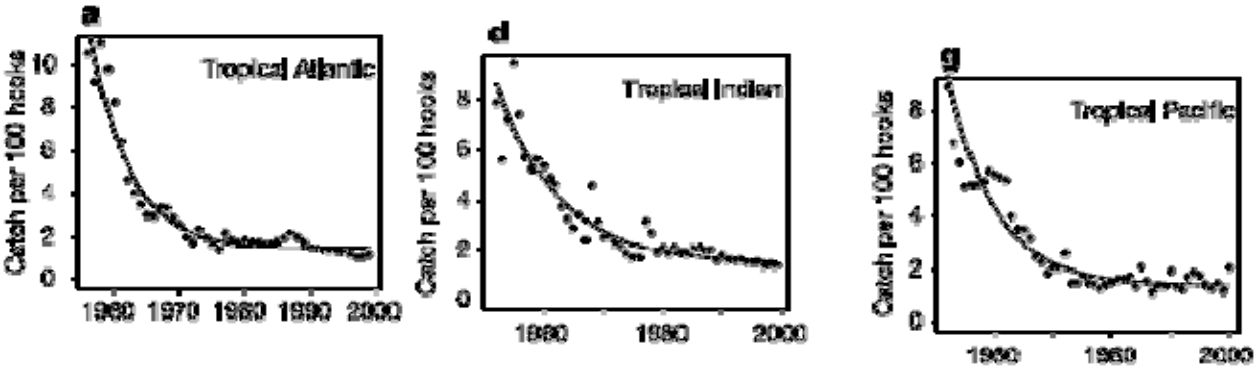
[28] Nellemann, C., Hain, S., and Alder, J. (Eds). 2008. *In Dead Water – merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds.* UNEP, GRID-Arendal, Norway, www.grida.no

[29] www.coml.org

[30] www.iobis.org

[31] *Biodiversity*. Ch 4. in Millenium Ecosystem Assessment

Fig.1. Trends in catches in oceanic ecosystems between 1960 and 2000[32]

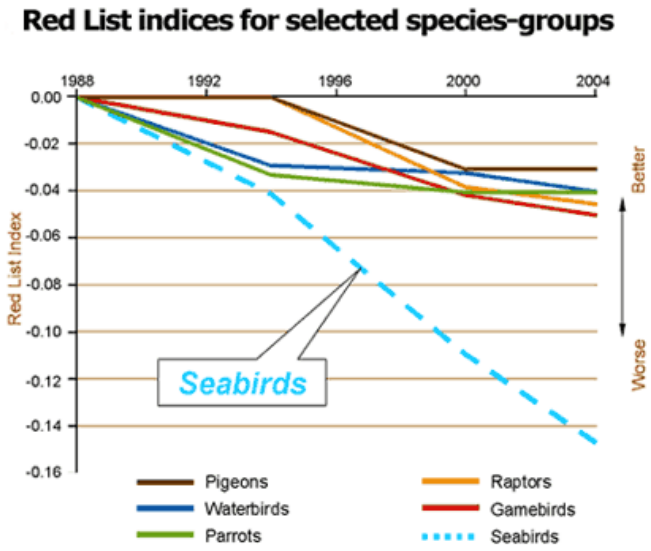


Fish: The global decline of commercially important fish stocks or populations is relatively well documented (see examples in Fig.1). All recorded shark species within the North Atlantic, with the exception of makos, have experienced a decline of more than 50% in the past 8–15 years, largely due to increased bycatch from pelagic long-line fisheries and direct exploitation for shark fins. Sharks grow and reproduce slowly, so even if exploitation were stopped, their recovery would be slow [24].

Populations of coral reef fish are also declining in abundance, particularly those species that depend on corals for food or shelter[33].

2.1.3. Change in status of threatened species

The IUCN Red List[34] is the most objective and authoritative listing of species considered globally at risk of extinction. Species are assigned to different categories depending on the degree of threat, which is assessed in detail through a process involving numerous experts and the relevant IUCN/SSC Specialist Group where this exists. At present, only 1,530 (3.7%) of the 41,415 species on the IUCN Red List (20 March 2008) are marine, with the majority being seabirds, turtles, marine mammals, sharks, and rays.



Marine extinctions have, until recently, been significantly under-rated and it is only now that the extent of local and regional extinctions are being understood, as well as the global implications of such events for marine biodiversity.

Measuring the change in status of threatened species requires that there are several assessments of a species according to the Red List criteria over time. Seabirds are the only marine species group for which such data are available and for which trends in the conservation status (i.e. whether the species are moving from a more threatened Red List

[32] Myers, R., and Worm, B. 2003. Rapid worldwide depletion of predatory fish communities. *Nature* 423: 280-283.
[33] Pratchett MS, Munday MS, Wilson SK, Graham NAJ, Cinner JE, Bellwood DR, Jones GP, Polunin NVC, McClanahan TR (2008) Effects of climate-induced coral bleaching on coral-reef fishes: ecological and economic consequences. *Oceanography and Marine Biology: An Annual Review* 46: 251-296.
[34] www.iucnredlist.org

category (e.g. Critical, Endangered) to a less threatened category (e.g. Vulnerable)) can be seen. The Red List Indices (RLIs) method has been developed to help measure this. The Red List Index for any particular taxonomic group is based on the number of species in each Red List category, and on the number of species changing categories between assessments as a result of genuine improvement or deterioration in status. An analysis for all bird species shows that their overall threat status has continued to deteriorate since 1988 (Figure 2); disaggregated indices show that particularly steep declines in the indices for seabirds and for albatrosses and petrels in particular (driven by incidental mortality in commercial longline fisheries) [35].

Marine mammals, sharks and turtles have also been assessed under the Red List criteria and ultimately it may be possible to undertake such analyses. The IUCN Species Survival Commission (SSC) Marine Turtle Specialist Group[36] (MTSG) conducts frequent updates to the Red List status of these species, drawing on a network of some 300 specialists around the globe. Regional initiatives linked with the MTSG include WIDECAST (in the Caribbean), the Mediterranean Sea Turtle Working Group, the IOSEA MoU (Indian Ocean and Southeast Asia), the Abidjan MoU (West Africa) and a new initiative for East Africa. Information is also being collated through the State of the World's Sea Turtles (SWOT) project, a partnership of Conservation International and the MTSG. The hawksbill was recently re-listed by the MTSG as Critically Endangered, but the Olive Ridley *Lepidochelys olivacea* was recently upgraded from Endangered to Vulnerable following a better understanding of their biology and population status, and as a result of conservation efforts. Reviews are underway for the Leatherback, the Loggerhead, the Kemp's Ridley and the Flatback. The MTSG has also started to introduce regional listings for distinct population segments, further refining the review and assessment process.

The IUCN/SSC Shark Specialist Group will publish its 2088 Global Shark Red List Assessment this year: a significant proportion of shark stocks qualify for inclusion on the IUCN Red List. Invertebrates and other fish species have received much less attention, partly because it was difficult to apply the Red List criteria. In 1996, a marine Red-Listing workshop on fishes led to refinement of some of the criteria to better reflect the specific characteristics of marine organisms. The SSC Marine Conservation Sub-Committee (MCSC) was established in 2005 to focus marine conservation initiatives and activities within the SSC,[37] and looks at bycatch, overexploitation in the context of the 2010 sustainability indicators, trade data, and promotes documentation of Life history spectacles, i.e. life history phases that are of critical importance for species or populations persistence, especially when these are exploited or otherwise impacted.

In 2005, the Global Marine Species Assessment (GMSA)[38] was set up as a joint effort of IUCN/SSC under the MCSC, with Conservation International (CI) and other partners, to review the conservation status of every marine vertebrate species and of selected invertebrates and plants, with a target of 20,000 species assessed by 2012. Priority taxa for assessment were identified at a strategy meeting in November 2005 using 10 criteria including amount of biomass extracted, economic value, by-catch, habitat deterioration, importance in community structure and function, intrinsically vulnerable life history regime, and feasibility of successful completion of a comprehensive Red List Assessment for the entire taxonomic group in question. The priorities include all fish, habitat-forming primary producers (sea grass, selected macro-algae, mangroves and corals) and invertebrates (e.g. selected mollusks and echinoderms - heavily exploited

[35] Butchart SHM, Stattersfield AJ, Bennun LA, Shutes SM, Akçakaya HR, et al. 2004. Measuring Global Trends in the Status of Biodiversity: Red List Indices for Birds *PLoS Biology* 2(12) e383 doi:10.1371/journal.pbio.0020383

[36] http://www.seaturtlestatus.org/ http://www.seaturtlestatus.org/

[37] C. Campagna & Y. Sadovy 2006. Final report: Strategic Planning Meeting for the SSC Marine Conservation Sub-Committee, November, 2006, Wattens, Austria. 35 pp.

[38] http://www.sci.odu.edu/gmsa

sea cucumbers). The GMSA is using the assessment methodology developed by IUCN's Biodiversity Assessment Unit, and data are entered into IUCN's Species Information Service database. Distribution maps are compiled for each species, using information from published journal articles and books, fisheries data, museum collections, and FishBase. Some species groups are easier to assess on a global level; for example, expertise in the IUCN Grouper and Wrasses Specialist Group permitted a global assessment of these two taxa as a whole, but regional workshops were necessary for sharks and rays, and for the reef-building corals. Corals have been assessed in the Caribbean, the Eastern Tropical Pacific and the Indo-Pacific regions; two of the most common coral species that previously had a high percentage of coral cover in the Caribbean, *Acropora palmata* and *A. cervicornis,* are already on the US Endangered Species list.

At the national level, several countries are starting to undertake the assessments needed to develop a better understanding of the status of marine biodiversity. For example, Germany has prepared Red Lists of endangered animal and plant species and biotope types for the marine and coastal areas of the German North Sea and Baltic Sea, and these will be revised by 2008.

Invasive Alien Species

Invasive alien species are an emerging threat to marine biodiversity, but have already transformed marine habitats around the world by displacing native species, changing community structure and food webs, and altering fundamental processes, such as nutrient cycling and sedimentation; they affect fisheries, foul ships' hulls, clog intake pipes, and damage human health. Only a small fraction of the many marine species introduced outside their native range thrive and invade new habitats, but once this happens, it can be almost impossible to eliminate it.

Before initiating eradication measures it is essential to understand which species are likely to be most harmful, their current distributions and how they are likely to be transported to new regions.[1]The Nature Conservancy (TNC) has therefore set up an online database of marine invasive species. A total of 329 species have been entered; the dominant groups are crustaceans (59 species), molluscs (54), algae (46), fish (38), annelids (31), plants (19), and cnidarians (17). The least invaded areas are the Southern and Arctic Oceans.

Considerable effort is being put towards reducing this threat. According to the CBD 3rd national reports, some countries have put mechanisms in place to control potential invasions from ballast water (30%), aquaculture (30%), accidental releases (16%), and hull fouling (7%). Australia has established a National Introduced Marine Pests Coordination Group (NIMPCG) to develop a comprehensive national system for the prevention and management of marine pest incursions; In Canada, control of ballast water is being undertaken in accordance with "Voluntary Guidelines for the Control of Ballast Water Discharges from Ships Proceeding to the St. Lawrence River and Great Lakes"; China and South Africa have developed strategic plans of ballast water management through the demonstration projects of GloBallast (GEF/UNDP/IMO global project of ballast water management); and Malaysia conducted a regional workshop, through the initiative of NACA, on alien-species carrying pathogens.

Sources: www.nature.org/marineinvasions; and Molnar, J.L., Gamboa, R.L., Revenga, C. and Spalding, M.D. 2008. Assessing the global threat of invasive species to marine biodiversity. *Frontiers in Ecology and Environment* 6.

2.2. Marine and Coastal Protected Areas

The CBD 3rd national reports submitted by Parties to the CBD during the period of 2005-2008 show that many Parties are addressing MPAs, or Marine Management Areas (MMAs) as they are generally known in the Pacific, in their national strategies and actions plans (Table 2).

Table 2. Parties reporting MPA progress in their 3rd national reports to the CBD, as of January 2008. Total number of reporting countries = 123.

Conservation Action	% reporting countries (no. countries)
Designated some MPAs	67% (83)
Plans exist to develop new MPAs	75% (92)
Effective management with enforcement and monitoring	52% (42)
Plans to improve management	74% (91)
MPA system under development	49% (60)
MPA system in place	28% (34)

This section looks at the following key parameters involved in meeting the 2012 MPA target:

- Area coverage of MPAs in relation to the 10% target
- Development of representative, resilient and connected networks or systems[39] of MPAs
- Management effectiveness

2.2.1. MPA number and area

Although the 2010 target for protected areas is that 10% of each biogeographic region and habitat should be protected, many scientists and conservationists consider that for MPAs the target should be considerably higher, possibly up to 30%. According to MPAGlobal, the database developed by the Sea Around Us Project in collaboration with UNEP-WCMC, WWF and IUCN-WCPA, and now being reintegrated with the World Database on Protected Areas (WDPA), in March 2008 there were an estimated 4435 MPAs worldwide, covering about 2.35 million km^2 which is equivalent to 0.65% of the world's ocean surface or 1.6% of the world's total EEZ coverage. This compares with the terrestrial environment which has 12% coverage by protected areas. Only 12.8% of the total MPA area (or 0.08% of the world's oceans) is no-take or strictly protected. At the current rate of progress, therefore it would not be until 2067 that 10% of the oceans would be protected, or 2047 to achieve protection of 10% of the world's EEZs[40].

However, at the local level, considerable progress is being made. 67% of countries reporting to the CBD have designated at least some MPAs, and 75% have plans to create new MPAs (Table 2). At least 17 countries have made major commitments to increasing their MPA coverage, often with more ambitious and longer-term targets than those set under the CBD. Good progress is being made in many countries (Table 3) in protecting inshore waters and/or waters over the continental shelf. There is a growing tendency to designate large MPAs covering several linked ecosystems.

[39] The words 'network' and 'system' tend to be used interchangeably by different countries as there is no agreed definition for either term. The simplest interpretation of a 'system' is a group of MPAs within a country, in which case all countries with more than one MPA can be said to be making progress. However, a system or network of protected areas is now generally considered to have specific criteria of bioregional representativeness, adequacy, connectivity etc., and rather fewer countries have taken steps towards this.

[40] Wood, L.J., Fish, L., Laughren, J. and Pauly, D. in press. Assessing progress towards global marine protection targets: shortfalls in information and action. *Oryx*

Table 3. Examples of national and regional progress in MPA establishment. Sources: CBD 3rd national reports, UNEP-WCMC (in prep.); 2008-2010 strategy of the Global Islands Partnership.

Country/region	
Palau, Federated States of Micronesia, Marshall Islands, Guam and Northern Marianas	*Micronesia Challenge:* a joint commitment by the five countries to conserve at least 30% of their nearshore waters and 20% of their terrestrial resources by 2020 - more than 20% of the Pacific Island Region and 5% of the Pacific Ocean,
Kiribati	Phoenix Islands Protected Area (PIPA) - covers 410,000 km^2 and includes much of the country's EEZ; largest MPA in the world.
Fiji	commitment to implement a network of MMAs in 30% of its Exclusive Economic Zone (EEZ) by 2020
Australia	Establishment of an MPA system that is 'comprehensive, adequate and representative,'; each state is developing its own system, and the Commonwealth is responsible for establishing an MPA system in non-state waters. By 2005, there were 214 MPAs, and about 7.5% of the EEZ is protected (1.6% of mainland EEZ and over 10% of its EEZ around its offshore islands), of which 3% was no-take; Australia has the world's second largest MPA, the Great Barrier Reef Marine Park.
East Timor, Malaysia, Papua New Guinea, Philippines, Indonesia, Solomon Islands	Coral Triangle, with support from Australia, the US, the GEF, ADB and several NGOs.
Indonesia	target to gazette 10 million ha of its waters as MPAs by 2010, and 20 million ha by 2020. There are currently about 120 MPAs, and over 70 new sites have been proposed. A National Committee for Marine Conservation has been established to review the existing network and identify gaps.
Vietnam	
China	90 marine nature reserves by 2004, of which 24 are at national level
Seychelles, Comoros, Madagascar, Mauritius	working to improve the management and ecological status of more than 26 marine protected areas in their region, with partners pledging 1.9 million Euros to support and expand the initiative
South Africa	Target to protect 20% of the coastline by 2010; by 2005, there were 23 MPAs; 23% of the coastline lies within an MPA, and 9% in no-take areas; networks of MPAs are also under development for the offshore component of the EEZ and for the EEZ surrounding Prince Edward Islands.
Antigua and Barbuda, Bahamas, Barbados, Belize, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, St. Kitts and Nevis, St. Vincent and the Grenadines, and Trinidad and Tobago	The Caribbean Challenge brings together these island nations which have committed to protect 10% of their marine ecosystems by 2010 with the support of a 20 million US$ grant from TNC; some countries have parallel national goals.
Brazil	2006 National Plan for Protected Areas; 145 coastal and 22 marine candidate sites have been identified and there are also a number of existing MPAs.
Canada	National MPA strategy for a federal network of MPAs covering all three of the oceans has been developed. In addition to the existing Marine Parks established by Parks Canada, six Marine Protected Areas have been gazetted by Fisheries and Oceans Canada, including British Columbia's Endeavour Hydrothermal Vents (2003), the Gully off Nova Scotia which is the largest marine canyon in the western North Atlantic (2004), and four other new Atlantic MPAs (2005 and 2007).
Norway	500 coastal nature reserves established under the Nature Conservation Act of Norway
Germany	established ten MPAs in its EEZ in the North Sea and Baltic Sea as a contribution to the Natura 2000 network

2.2.2. Networks of MPAs

Although number of MPAs and the area they cover provide useful information on progress towards conserving biodiversity, these indicators do not show whether a group of MPAs operates as a network or system. Several sets of criteria have been identified for measuring the adequacy of networks, but the key features are:

- adequacy – size and spatial distribution;
- representation – inclusion of the full range of biodiversity;
- resilience (or replication) – ensuring that the network can withstand major impacts by including multiple samples; and
- connectivity – ensuring linkages between sites through larval and adult dispersal, currents etc.

National networks

Table 3 provides examples of some of the initiatives underway to develop planned networks or systems of MPAs at different spatial or geographical scales.[41] 28% of countries reporting to the CBD report that they have a national system in place (although the reporting system does not require elaboration as to how this system is defined), and 49% report that they are developing a system.

At the global level, there is far from adequate representation of all ecosystems and biogeographic regions. About 65% of the total marine area protected is in tropical waters, with most of the remainder in the northern hemisphere; southern temperate and polar latitudes are least well represented. Most MPAs are on the continental shelf and in coastal waters; an estimated 4.3% of shelf areas to 200 m depth are protected. At the ecosystem level, an estimated 17-19% of global mangrove cover, 15-22% of coral reefs, 10% of seagrass beds, 8% of estuaries and 2% of seamounts lie within MPAs. For coral reefs, mangroves and seagrass beds, the CBD target has thus been met, but for such ecosystems – with small total areas and precipitous declines – a much greater proportion than 10% should be protected. Finer scale regional level assessments are also needed; in the North-East Atlantic, for example, it has been found that 13 of 22 biogeographic zones still have no MPAs. A growing number of MPAs are being established for deep sea habitats; for example, Canada and the Azores have protected hydrothermal vents; the UK, USA and Norway have protected cold water corals; and the Azores, Madeira and New Zealand have closed areas of deep sea benthic habitat to trawling[42]. Although large areas of pelagic water are found within MPAs, few sites have been designated specifically for this ecosystem[43].

The principle of resilience has been used relatively little in the planning of MPA networks, but TNC is testing guidelines for addressing resilience in MPA design in relation to coral reefs and spawning aggregations at several sites. Similarly, few networks have addressed connectivity but rapid research in this field is yielding information that can be used for management. For reef species, there is growing evidence that dispersal distances of larvae are less than previously thought and there are indications that there may be significant genetic differences between reefs as close as 10-20 km apart. Inter-MPA distances within a network may therefore need to be as little as 20 km. A preliminary assessment suggests that just over 50% of existing MPAs are within at least 10-20 km of another MPA[40]. Further research is needed, as well as analysis of existing networks to determine future best practices in relation to connectivity.

Regional networks

At the regional level, MPA network planning requires a multi-country collaborative approach. Regions with a strong co-ordinating framework and supporting treaty or agreement, such as those participating in the

[41] *Establishing national and regional networks of MPAs – a review of progress with lessons learned*. Report to UNEP-World Conservation Monitoring Centre and the UNEP Regional Seas Programme.

[42] Report of SBSTTA13

[43] *Establishing national and regional networks of MPAs – a review of progress with lessons learned*. Draft report to UNEP-WCMC and UNEP Regional Seas Programme, 2008

UNEP-RSP, have generally progressed furthest. Regional networks of MPAs are well advanced in the North-east Atlantic and Baltic regions, through the OSPAR and HELCOM processes. Six of the UNEP-RSP regions (Black Sea, East Africa, Mediterranean, North-east and South-East Pacific, Wider Caribbean and Antarctic) have Protocols that assist in the establishment of MPAs. The Mediterranean and Wider Caribbean have Regional Activity Centres for biodiversity and protected areas that support work on MPAs and encourage a more focused and collaborative approach, with relatively well-organized regional networks of organisations and individuals. The Regional Organisation for the Protection of the Marine Environment (ROPME) Region is working on the development of an MPA programme.

Regional MPA network initiatives are also underway through the WWF Ecoregion programmes (e.g. East Africa, Western Indian Ocean, West Africa, Fiji, Sulu-Sulawesi Sea), and with support of LME (e.g. West Africa) and WCPA-Marine projects (e.g. South-East Asia). The Micronesia and Caribbean Challenges, and the Coral Triangle Initiative, are examples of regional networks championed by island nations that work together to exchange experiences and strengthen collaboration through the Global Islands Partnership (GLISPA), an open platform of 20 island Parties, Parties with islands and international and regional organizations[44].

In several cases, smaller regional MPA networks are being developed within larger initiatives. Europe has many layers of this nature, with some 10 agreements and initiatives that are developing the MPA system approach, e.g. Natura 2000, Emerald network, four Regional Seas and related Programmes (Mediterranean, Black Sea, OSPAR and HELCOM) and the North Sea Conference. East Asia also has a large number of inter-related sub-regional programmes including the WCPA-Marine South-East Asia MPA system plan for South-East Asia, the WWF and CI supported Indonesian/Philippine/Malaysian initiative to establish an MPA system for the Sulu-Sulawesi area, as well as a number of national initiatives. The Coral Reef MPAs of East Asia and Micronesia is a joint project between the WorldFish Centre and the Japan Wildlife Research Centre to gather information on MPAs with coral reefs throughout the region.

High Seas MPAs (HSMPAs)

Some 64% of the world's oceans (c. 202 million km^2) are in areas beyond national jurisdiction, and include fragile habitats (e.g. cold water coral reefs, sea mounts and hydrothermal vents) with high biodiversity that are relatively rare in waters under national jurisdiction. At the World Parks Congress in 2003, a target was set to have at least five ecologically significant MPAs designated on the high seas by 2008. There have been several initiatives to identify sites that might be included in a HSMPA system and criteria are being developed. There are significant issues in relation to the legal and implementation arrangements for HSMPAs and these are discussed elsewhere.

Roberts et al. (2005)[45] used MARXAN with global datasets for several taxonomic groups to design an ecologically representative network of potential High Sea marine reserves, that they recommend should be made off limits to all extractive and destructive uses. The network comprises 25 'marine reserves' and four 'reference sites' and would cover over 40% of the world's oceans. The proposed sites are representative and comprehensive in relation to data on water temperature gradients, upwellings, hotspots for large and vulnerable species, sea mounts and other seabed characteristics. Cheung et al. (2005)[46] highlight the following priorities:

- the high seas of the Indo-Pacific, specifically centered on SE Asia,

[44] http://www.cbd.int/island/glispa.shtml

[45] Roberts, C.M., Mason, L. and Hawkins, J.P. 2005. *Roadmap to Recovery: a global network of marine reserves.* Greenpeace

[46] Cheung, W., Alder, J., Karpouzi, V., Watson, R., Lam, V., Day, C., Kaechner, K., and Pauly, D. 2005. Patterns of Species Richness in the High Seas. Technical Series No. 20, Secretariat of the Convention on Biological Diversity, Montreal. 31 pp.

Northern Australia and the Tasman Sea;
- seamounts in the high seas of the North and South Atlantic, and the Southern Ocean convergence zone, especially as protecting seamounts and surrounding areas will help to protect cold-water corals;
- high seas areas adjacent to islands in the Southern Ocean; and
- small shelf areas in the high seas of the Northeast and Northwest Atlantic.

Potential HSMPAs have also been identified by analyzing sea-bird sighting data in the Southern Ocean, on the basis that seabird distributions reflect the distribution, abundance, and availability of their prey, and that high densities of seabirds and/or seabird species diversity is observable in specific areas over decadal scales. This approach could be particularly useful in relation to climate change, since prey and predator species may migrate over the course of coming decades; studies could be repeated in, say, 50 years' time, and if the at-sea distributions of seabirds change in response to rising sea-surface temperatures, new candidate MPAs could be identified[47].

2.2.3. Management Effectiveness of MPAs

Ensuring the effective management of existing marine and coastal protected areas is as important as establishing new areas. According to the 3rd CBD national reports, 42% of Parties reported that effective management of MPAs has been put in place with enforcement and monitoring, but it is not known on what basis such judgments were made. 31% reported having an MPA system surrounded by sustainable management practices, and 38% responded that their national MPA systems include areas excluding extractive uses (i.e. no-take zones). The general experience is that many MPAs are having difficulty meeting their objectives, with funding shortfalls, low compliance, lack of enforcement, and other challenges.

[47] Harris, J and Woehler, E. 2007. A New Approach to Selecting Marine Protected Areas (MPAs) in the Southern Ocean *Antarctic Science* 19(2): 189-194

3. Major obstacles and challenges

The obstacles and challenges to conserving marine biodiversity and MPAs are similar to those for biodiversity conservation in general. In their reports to the CBD and in other reviews[48], Parties have tended to rate similar challenges in the implementation of various articles, provisions and thematic areas of the CBD [49,50]. They are summarised as follows and discussed in more detail in Section 4 where policy recommendations to overcome these challenges are described.

3.1. Lack of political commitment and support, and political instability: This is often due to poor understanding of the benefits, goods and services of biodiversity and its contribution to sustainable development. It can lead to a lack of leadership; low national priority for biodiversity conservation and protected areas; and a poor understanding of national commitments and international obligations; and poor regional cooperation; competition for time amongst decision makers in light of other global and regional events (such as wars, diseases, etc.); lack of access to and required skills for working with / informing decision makers amongst the conservation community;

3.2. Institutional and policy obstacles and weaknesses: lack of vision, attitude and perceptions; lack of inter-sectoral coordination; conflicting legislation; contradictory government policies limiting opportunities; lack of multi-stakeholder coordination mechanisms; limited marketing strategies for protected area goods and services; low willingness of governments to implement assessment results; bureaucratic hurdles; lack of transparency in decision-making process; inadequate law enforcement; lack of legislative and policy measures to retain revenue generated by protected areas; lack of cooperation between NGOs and government institutions;

3.3. Insufficient human and technical resources and capacity: inadequate and

[48] Sub-regional capacity building workshops on protected areas conducted by the CBD in 2007
[49] Document UNEP/CBD/WG-RI/2/INF/1
[50] Document UNEP/CBD/WG-PA/2/2

poorly qualified staffing; lack of committed and enthusiastic personnel; lack of incentives for dedicated staff; non-continuity of trained personnel and change of staff;

3.4. Limited financial resources: insufficient government allocations – low priority for protected areas; lack of compensatory mechanisms; high reliance on one source of funding; lack of local capacity to generate revenue; resistance to create new taxes; limited skills to develop suitable funding proposals and follow through with donors;

3.5. Lack of suitable data and poor skills in data use: weak linkages in data collection and analysis; lack of standardized data collection and management; lack of use of the vast current array of data; lack of decision making skills on limited but useful data sets;

3.6. Lack of 'suitable' and easily applicable guidelines/tools and insufficient training in their use: lack of simple, easily understandable methods and guidance in local languages and inadequate dissemination of such materials where they exist; training and information on economic valuation of biodiversity and protected areas, fund-raising (resource mobilization), and in GIS and mapping have been identified in particular. Guidelines and similar tools are not necessarily the best means for people to learn complex activities such as MPA management unless accompanied by appropriate training; sharing of experiences through workshops and exchange visits are also valuable.

3.7. Low awareness: by the general public, biodiversity managers, and politicians of the importance of biodiversity conservation, and of the requirements of the CBD;

3.8. Limited or low involvement of indigenous and local communities and various stakeholders: inadequate involvement of indigenous and local communities; inadequate participation of scientific and academic community; local community resistance; limited public participation;

3.9. Lack of mainstreaming and integration of biodiversity issues into other sectors.

3.10. Lack of economic incentives: lack of adequate mechanism of sharing benefits arising from the use of biodiversity resources; and limited technology transfer.

4. Priority Policy Issues to Move Forward

There are two key priorities:

- reducing the current rate of loss of marine biodiversity; and
- improving our ability to measure progress towards the 2010/2012 targets in relation to marine biodiversity.

4.1. Reduce the rate of loss of marine biodiversity

The efforts required to reduce the rate of loss of marine biodiversity are two-fold:

4.1.1. Accelerate efforts to reduce CO_2 emissions

Given the immense threat that global climate change poses to marine ecosystems and species, there is an immediate need to accelerate local and global actions to reduce CO_2 emissions. This is not discussed further in this Policy Brief, since it is well documented elsewhere, but the fact that climate change is already having a noticeable negative impact on marine ecosystems that provide essential goods and services is a key argument for some of the essential political, economic and social changes that are required. For example, it has been suggested that atmospheric CO_2 concentrations must be reduced to below double pre-industrial levels if coral reefs are to survive in something resembling their current form given their vulnerability to seawater warming and ocean acidification[51].

[51] Wilkinson, C., Souter, D.and Goldberg, J. 2005. Status of Coral Reefs in Tsunami Affected Countries: 2005. Australian Institute of Marine Science, Townsville, Queensland.

4.1.2. Accelerate efforts to address immediate/local impacts in order to increase resilience

Given that there is evidence that healthy marine ecosystems and communities have greater resilience to some of the negative impacts of global warming, there is a second immediate need to reduce and eliminate where possible those human activities that are contributing to the loss of marine biodiversity. This will involve:

- Improving fisheries management to reduce overfishing and the use of damaging fishing methods;
- Introducing effective integrated catchment and coastal zone management programmes and the ecosystem-based approach to minimise the inflow of polluting sediments and nutrients, regulate tourism development, and ensure appropriate land use planning in locations that have an impact on the marine environment;
- Establishing effectively managed MPA networks;
- Promoting of environmentally sound ecosystem restoration where appropriate.

In this Policy Brief, we outline specific needs in relation to coral reefs, MPAs, ecosystem restoration and invasive species, given the particular relevance of these issues to the CBD.

4.1.3. Protection and Management of Coral Reefs

It is essential to make use of the opportunity provided by the designation of 2008 as the International Year of the Reef (IYOR) to push forward key measures to reverse their decline. Several important initiatives are already underway and should be continued and expanded as appropriate, including the GEF Lessons Learned and Best Practices Toolkit which has been developed to provide guidance on designing and implementing coral reef management strategies[52], ICRAN and its global programme (www.icran.org), and the World Bank-funded Coral Reef Targeted Research and Capacity Building for Management (CRTR) Programme (www.gefcoral.org)… There have been numerous sets of recommendations for coral reefs (e.g. ICRI recommendations and resolutions, recommendations of the GCRMN annual Status Reviews of Coral Reefs of the World, WRI's Reefs at Risk initiative, and 2004 Okinawa Declaration (endorsed by participants to the 10th International Coral Reef Symposium). The following provides a brief summary of some of the more urgent steps to be taken:

1. Strengthen the impact of ICRI
Although it is the highest global body concerned with the future of coral reefs and their conservation and management, ICRI has relatively poor representation of the 101 countries with coral reefs. ICRI is not a formal treaty-based mechanism which means that NGOs may participate and interact directly with government representatives which has much value. But it also allows members to act independently, and there is no official evaluation mechanism or requirement to link with other formal processes, which weakens its impact. ICRI could therefore be strengthened by:

- Encouraging all coral reef countries to participate and, where appropriate, establish a national coral reef task force or committee as part of their coastal/marine management process; coral reefs should be highlighted in national coastal management plans and, where this does not duplicate work or detract from existing efforts, national coral reef management and monitoring plans should be produced and implemented.
- Assessing progress in implementation of national coral reef plans, and/or components of national coastal management plans relevant to coral reefs and reporting the results regularly to the CBD via SBSTTA in order to evaluate progress in relation to the Jakarta Mandate, Millennium Development Goals, WSSD goals etc.

[52] http://gefll.reefbase.org

2. Reduce, and where possible remove, the direct pressures on coral reefs
The direct pressures on coral reefs are in most instances the same as those threatening other marine ecosystems, and the solutions are well known: promote integrated catchment and coastal management, sustainable management of coral reef fisheries, including halting the use of damaging fishing practices such as dynamite and protecting spawning sites and breeding stocks in no-take MPAs; and establishing effectively managed networks of MPAs to protect and restore coral reefs.

3. Improve enforcement of policies and regulations that promote effective reef management

- ensure that local user communities and the private sector are aware of relevant policies and regulations and have the skills and resources to implement them;
- promote market-based and other incentives for communities and governments to manage their coral reefs sustainably;
- quantify and promote the role that effective management of coral reef resources can play in sustainable development and poverty alleviation, and develop supplementary livelihoods to reduce the need to over-exploit coral reef resources;
- devolve sufficient authority to communities to develop and run their own no-take MPAs and implement enforcement; and develop joint enforcement mechanisms between government and communities to enforce coral reef related legislation;
- strengthen the judiciary, court procedures and penalties so that community efforts are supported and infringements treated seriously; and
- recognise the role of appropriate traditional knowledge and management methods in coral reef conservation and help governments harmonise these with state and national laws.

4. Improve capacity for coral reef management:
Many coral reef countries lack adequate trained personnel and resources for coral reef management, awareness raising, enforcement and monitoring, and there is a need for a range of capacity building activities (see recommendations).

4.1.4. Strengthen and expand national and regional MPA networks and improve their management

MPA network planning must start, or be accelerated, in all coastal countries as soon as possible, and implementation fully addressed, if real progress is to be made by 2012. Lack of funding and political will is proving to be a major constraint in many countries. Parties should promote full and effective participation of indigenous and local communities, in accordance with the national legislation and applicable international obligations, when establishing new MPAs, taking into account, as appropriate, the UN Declaration on the Rights of Indigenous Peoples.

Gaps in MPA network development at the regional level could be reduced through improved coordination between countries, facilitated by organizations such as UNEP-RSP, WCPA-Marine, WWF and TNC; the international organizations should also co-ordinate closely. 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 is required, both within and beyond areas of national jurisdiction. UNEP-WCMC is conducting a review of the approaches and coordination opportunities for implementing MPAs in areas beyond national jurisdiction in a report to be released in 2008. IUCN WCPA-Marine is developing a regionally-based coordination framework on MPAs, and an expert network to assist countries in developing MPAs.

1. Expanding MPA networks

MPA networks need to be larger, contain the most resistant and resilient populations of marine organisms, and be connected in such a way to ensure free transfer of larvae, juveniles and adults to restock populations and repair damage. Scientific guidance has been provided

for designing representative networks by the CBD Expert Workshop on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection. Four initial steps to be taken (Annex III) were recommended for the development of such networks in open ocean waters and deep-sea habitats.

Regional initiatives should be supported and promoted, such as the regional initiative to develop MPA networks in the East Asia region, led by Japan, which will host a workshop in November-December 2008, with a series of follow-up meetings until 2010. A framework for regional cooperation will be developed, and the regional MPA database *Coral Reef MPAs of East Asia and Micronesia* expanded[53].

MPA networks must also be considered as part of broader marine spatial planning (MSP) or ocean zoning, and as part of integrated coastal management[54]. MSP, which is broadly equivalent to land use planning in the terrestrial environment, is already an agreed approach in several countries and regions including UK, Belgium, Netherlands, Canada, North Sea, China and Germany[55]. The South-east Region MPA System Plan in Australia demonstrates how an MPA network can be integrated into a range of broader measures, such as recovery plans for listed species, fishery management closures and regulations for oil and gas activities. Belize demonstrates how a national MPA system can be part of an integrated coastal management plan, can link with regional systems of MPAs (in this case through the MAR initiatve), and also incorporate international protected area designations (the Belize Barrier Reef World Heritage Site). On a smaller scale, waters around several islands are now fully zoned, incorporating MPAs with different levels of protection (e.g. Cayman Islands, Socotra Island in Yemen, San Andres Archipelago in Colombia).

2. Improve management effectiveness of MPAs

Improving management effectiveness requires capacity building and training, as well as better planning and implementation of management plans and involving local communities in the design and management of MPAs and enforcement of regulations. Increasing the area of MPAs and MPA networks that is closed to fishing also improves effectiveness.

Another key tool is assessment of management effectiveness. This determines both the conservation impact of the MPA (i.e. what was achieved) and its management performance (i.e. how it was done), and thus helps to identify where improvements are needed. Under the 2004 CBD POWPA (Goal 4.2) 30% of protected areas should be assessed for their management effectiveness by 2010. Assessment methods range from the detailed indicator-based approach developed by NOAA/WCPA-Marine, to the simple score cards developed by the World Bank, as well as region-specific methods (e.g. IUCN/WIOMSA workbook Western Indian Ocean MPAs). Information on these methods and the MPAs where they have been used is available in the online Protected Areas Management Effectiveness (PAME) Information Module developed by UNEP-WCMC and IUCN-WCPA and linked to the WDPA[56].

There has been no comparative analysis of methodologies and the various pilot assessments to determine whether certain methods are more suitable for MPAs, and whether MPAs have characteristics that warrant a specific approach. There has also been no review or analysis of management effectiveness evaluations undertaken for MPAs, and thus no understanding of the progress being made towards the target of achieving such evaluations in 30% of protected areas by 2010. It is recommended that experiences and tools in evaluation of management effectiveness of MPAs should be

[53] http://www.icriforum.org/EastAsiaRW2008.html

[54] Belfiore, S., B. Cicin-Sain, and C. Ehler, Eds. 2004. *Incorporating Marine Protected Areas into Integrated Coastal and Ocean Management: Principles and Guidelines.* IUCN, Gland, Switzerland and Cambridge, UK. viii + 38pp.

[55] *Establishing national and regional networks of MPAs – a review of progress with lessons learned*. Draft report to UNEP-WCMC and UNEP Regional Seas Programme, 2008

[56] http://www.unep-wcmc.org/wdpa/me

shared, case studies compiled and disseminated, and an information-sharing forum established[57], and that such results and experiences from all marine assessments are pooled[58].

4.1.5. Invasive species

Ongoing efforts to improve ballast water management practices (eg International Maritime Organization's Ballast Water Convention and Management Programme; http://globallast.imo.org) should be supported. In addition, given the role of aquaculture operations in marine invasions, stricter, industry-wide control measures should be developed and legal and enforcement structures strengthened to restrict intentional and accidental introductions of harmful species. The WWF-led initiative[59] to develop standards with the aquaculture industry will contribute to this process.

4.1.6. Promote marine ecosystem restoration where appropriate

Most damaged marine ecosystems will recover naturally once a stress has been removed but this can be slow. It is tempting to try and speed recovery through active restoration but this is rarely totally successful because of the difficulties involved in re-establishing full biodiversity and ecological processes. However, increasingly there may be certain situations or conditions when active intervention is necessary or beneficial, for example where an ecosystem has particularly high economic value or scientific interest[60]. Techniques for restoring coastal wetlands are well advanced and this is being practiced in many parts of the world. Mangrove restoration is also relatively simple and large areas of new mangrove forest are being created using volunteers and local labour, although these rarely have the full complement of biodiversity. A variety of seagrass restoration techniques are being tested n the USA[61].

Coral reefs are much more difficult to restore and there are few examples of successful projects. Methods are costly and require considerable skill, although there have been recent advances which give cause for hope, particularly as a result of work undertaken through the European Commission funded REEFRES project and the GEF/World Bank funded CRTR programme Working Group on reef restoration. The relative aptitudes of different coral species for nursery rearing and transplantation are being assessed and cost-effective methods developed. At present however, active reef restoration should be restricted to those reefs where it is essential and for which there is a reasonable chance of success[62].

4.2. Improving mechanisms for assessing progress towards the 2010/2012 targets

Uncertainties as to the present loss rate as a result of the paucity of coherent monitoring programmes, and the difficulty in formulating reliable predictions about the future rate of loss, are a major barrier to the development of global conservation policies. As shown earlier, in the marine environment, with a few exceptions, we still lack the information to permit a clear assessment of progress towards the 2010 biodiversity targets despite the large number of thematic and other forms of assessment underway. The following are some of the key priorities:

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[57] Conclusions and recommendations of workshop on designing and implementing MPA management effectiveness evaluation, International Marine Protected Area Congress (IMPAC), 2005.

[58] Recommendations of the 2006 TNC report: *Measuring Conservation Effectiveness in the Marine Environment: a review of evaluation techniques and recommendations for moving forward.*

[59] WWF Aquaculture Dialogues www.worldwildlife.org/aquadialogues

[60] UNEP-WCMC (2006). *In the Front-line: shoreline protection and other ecosystem services from mangroves and coral reefs*. UNEP-WCMC, Cambridge, UK. 33 pp.

[61] Final Programmatic Environmental Impact Statement for Seagrass Restoration In the Florida Keys National Marine Sanctuary. http://sanctuaries.noaa.gov/library/fk/seagrass_fpeis04.pdf

[62] Edwards, A.J. and Gomez, E.D. (2007). *Reef Restoration Concepts and Guidelines: making sensible management choices in the face of uncertainty*. Coral Reef Targeted Research & Capacity Building for Management Programme: St Lucia, Australia. 42 pp.

4.2.1. Establish suitable marine indicators

The CBD is identifying a set of indicators in relation to diversity and protected areas in general. Specific indicators for marine diversity have not been identified at either global or national levels and no guidance has been given on how the general indicators might be applied to the marine situation. However, as suggested in the Millennium Ecosystem Assessment, quality and extent of certain ecosystems, such as coral reefs, seagrasses and mangroves, might be feasible. The UNEP-WCMC project on 'Biodiversity Indicators for National Use'[63] identified some of the challenges in determining effective indicators through a series of pilot initiatives; marine biodiversity indicators were tested by the Philippines. Development of indicators should be undertaken with reference to the work underway to develop process indicators for ecosystem-based management.

4.2.2. Improve baseline data

Although several programmes are addressing the lack of data on marine biodiversity (e.g. CoML), all countries and relevant organizations need to increase efforts to improve basic understanding. Inventories and baselines, with associated monitoring programmes, are needed especially for seabed habitats and marine areas known to be in need of protection, the high seas and deep oceans, developing nations and SIDs, and the Southern Hemisphere. A co-ordinating mechanism for existing programmes is also needed – the preparation of this Policy Brief demonstrated the lack of any central source of information on trends in marine biodiversity, and the wide range of organizations and information centers that have to be contacted to carry out even a preliminary assessment.

4.2.3. Strengthen marine biodiversity monitoring and include ecological processes (e.g. recruitment, trophic interactions, resilience)

For some ecosystems and species, specific needs have been identified:

Coral reefs: Further support is needed from appropriate UN organizations and the GEF for establishing and maintaining national coral reef monitoring and management programs in each of the 101 coral reef countries. Without a strategy and regular tracking of coral reef condition, it is impossible to determine whether management actions including the establishment of MPAs have been successful in protecting a significant percentage of reefs and biodiversity. For example, ReefCheck, the only regular standardized tracking at a regional and global scale, still has many gaps in coverage, both geographically and temporally, although only relatively minor additional financial support is needed to fill these – all 101 coral reef countries should be participating in GCRMN/ReefCheck. At present relatively few scientists or coral reef monitoring programmes are contributing information to ReefBase, which was set up to be the focal point for reef information. Attention needs to be paid to improved co-ordination between the various initiatives and organizations involved with global assessment of coral reefs.
Mangroves: Both FAO and UNEP-WCMC are monitoring trends. UNEP-WCMC has reviewed the status and distribution of mangroves in 7 countries in east Africa and 19 in West and Central Africa, and is planning the production of a global mangrove atlas, based on an earlier one produced in 1997. Support for co-ordination and establishment of a single global monitoring programme is needed.

Seagrasses: Key actions needed include the development of a coherent worldwide monitoring network, the development of quantitative models predicting the responses of seagrasses to disturbance, and the education of the public on the functions of seagrass meadows and the impacts of human activity[64].

High Seas: CBD, in collaboration with UNEP-WCMC, has reviewed spatial databases containing information on marine areas in areas beyond national jurisdiction and has

[63] Bubb, P., Jenkins, J., Kapos,V., (2005). *Biodiversity Indicators for National Use: Experience and Guidance*. UNEP-WCMC, Cambridge, UK.

[64] Duarte, C.M. 2002. The future of seagrass meadows. *Environmental Conservation* 29: 192-206

developed an Interactive Map (IMap) for viewing these[65]. As UNEP-WCMC redevelops and builds the interactive capabilities of the new WDPA, access to these spatial databases will be enhanced. As reflected in the recommendations of the 13th meeting of the CBD SBSTTA[66], CBD and UNEP-WCMC need to further collaborate with the International Maritime Organization (IMO) and other organizations to promote the use of the IMap and continue to update it, incorporating information on ecosystem functions and connectivity, threats and habitats in the water column.

4.2.4. Strengthen reporting on MPA progress

This requires clarification of terminology, the development of indicators and criteria, harmonised biogeographical classifications and improved data collection.

1. Clarify terminology and definitions for MPAs

Clarification of the terminology used in developing MPA networks is needed to improve communication and to facilitate measurement of progress and comparison between national and regional initiatives. The UNEP Southeast Pacific RSP has recommended that clear definitions and standardised nomenclature for concepts such as MCPAs, MPAs, and networks should be produced and put forward as a global recommendation. Some discussions have already taken place (e.g. at the IUCN Categories Summit) but identified priorities include:

- A definition of the term 'coastal' in the context of the CBD's terminology for MCPAs (i.e. what types of protected areas qualify as 'coastal' rather than 'marine');
- Consideration of the need to define no-take areas as a sub-type of MPA; and
- Clarification of the meaning and use of the terms 'network' and 'system', and how these relate to broader MSP approaches (e.g. to what extent these terms imply connectivity and ecological relationships between sites).

2. Establish criteria to identify priority areas for protection and indicators to measure progress

Many Governments and some regional organizations have criteria to identify sites for MPAs within national waters and regional seas. Scientific criteria for identifying ecologically or biologically significant marine areas in need of protection, in open ocean waters and deep sea habitats have been developed as a result of work carried out in two workshops (Workshop on Criteria for Identifying Ecologically or Biologically Significant Areas beyond National Jurisdiction, December, 2005 in Ottawa, and the CBD Expert Workshop[67] on Ecological Criteria and Biogeographic Classification Systems for Marine Areas in Need of Protection, October 2007, Azores, Portugal). Seven criteria have been suggested:

(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.

The WSSD and CBD targets and indicators in place for measuring progress in protected area establishment are adequate for measuring progress in terms of area coverage, but there are no globally agreed indicators for assessing progress in the establishment of protected area systems that are fully representative, resilient and connected. WCPA-Marine has developed a self-assessment checklist for MPA networks which provides a preliminary tool that could be built on[68].

[65] UNEP/CBD/SBSTTA/13/INF/12
[66] UNEP/CBD/COP/9/3
[67] UNEP/CBD/SBSTTA/13/INF/14
[68] Day, J.C, & Laffoley, D.d'A., 2006. Self-assessment checklist for building networks of MPAs. WCPA IUCN.

3. Harmonise biogeographical classifications

Without well-tested and accepted biogeographic and habitat classifications at appropriate scales, it will not be possible to ensure that MPA networks are ecologically representative. The 'Marine Ecosystems of the World (MEOW)' classification[69] is a key tool for MPA system planning at a range of levels and is increasingly being adopted for global assessment purposes and is considered a useful tool by the CBD. It is restricted to the coast and shelf areas. An expert group drawn from workshops held over the preceding 18 months in Ottawa, Mexico City[70] and the Azores[71] has compiled a draft bioregional classification for global open-ocean and deep-sea areas (GOODS). This biogeographical classification is based on a physiognomic approach, which uses geophysical characteristics of the benthic and pelagic environments to select homogeneous regions of similar habitat and associated biological community characteristics. Where independent national or subnational classifications have been compiled and are being used, these should be reviewed to determine how they relate to these higher level global classifications. As reflected in the recommendations of the 13th meeting of the CBD SBSTTA, further work is needed to develop technical guidance on the use of global biogeographic classifications of ocean regions, and on how regional and subregional classifications, currently available or under development, can be aligned and nested within the global classifications. For example, there is a need to examine how the geographical boundaries of regions defined under programmes including UNEP-RSP, WCPA-Marine, LMEs and WWF ecoregions can be linked to the global classifications.

4. Improve data collection on MPAs

At present, national and regional data-gathering efforts are largely scattered and *ad hoc* which presents a challenge for the development and maintenance of a global database and assessment of the 2012 MPA target. A more structured national and regional approach is needed particularly in terms of measuring how much of the marine biome, and of each ecosystem within it, is protected. The recording of accurate information on the name of each MPA, its total area, area of intertidal and subtidal habitat, biogeographic region and ocean or sea, designation, legislation and governance, and presence and area of no-take zones is essential. This will help in both measuring the number of MPAs and the area of subtidal and intertidal water that is protected and thus be a valuable contribution to gap analysis activities, as well as to measuring progress towards targets. The recording of mangrove forest reserves, Ramsar sites and other designated areas over which there is some question as to whether they fulfill the definition of a protected area needs resolving. IUCN WCPA-Marine is developing a "wet list," and providing a web portal for MPA-related information. UNEP-WCMC is developing a mechanism for integrating existing MPA global databases, including MPAGlobal and covering important high seas areas; this will help to centralize the management and dissemination of global marine data so it is more accessible to users. With the redevelopment of the WDPA, to be launched at the World Conservation Congress in 2008, there will be greater interactive capacity for countries and sites to enter their MPA data directly, improved access to marine data, and an increase in the quantity and quality of the information available for analyses. The UNEP Regional Seas Programmes could play a role in gathering data at the regional level.

4.2.5. Strengthen periodic reporting procedures to cover marine biodiversity more effectively

A 'Regular Process' for producing a Global Marine Assessment (GMA), that would look at

[69] Spalding M, Fox H, Allen, GR., Davidson N, Ferdana Z, Finlayson M, Halpern B, Jorge M, Lombana A, Lourie S, Martin K, McManus E, Molnar J, Newman K, Recchia C, and Robertson J. 2007. Marine Ecoregions of the World: a Bioregionalization of coastal and shelf areas. *BioScience* 57(7): 573-583

[70] Workshop on Biogeographic Classification Systems in Open Ocean and Deep Seabed Areas beyond National Jurisdiction, January 2007

[71] Draft report on Global Open Oceans and Deep Sea-habitats (GOODS) bioregional classification. UNEP/CBD/SBSTTA/13/INF/19. 11 February 2008

the ocean system as a whole, was proposed at the WSSD in 2002. In December 2006, the 61st session of UNGA adopted a new resolution (A/RES/61/222), and agreed that a start up phase, or Assessment of Assessments should be undertaken. This will look at gaps in data availability, geographic coverage of existing assessments and thematic coverage, issues for which further research is needed, the extent to which goods and services are provided by marine ecosystems, anthropogenic threats, and the effectiveness of existing policies and interventions. UNEP has identified 130 relevant assessments and related activities undertaken by 73 organisations, of which 56 are global and 65 regional[72]. Some countries have felt that the Regular Process should be restricted to pollution and physical degradation and not concern living resources, but there is now broad recognition that marine biodiversity, including fisheries and ecosystem issues, is fundamental to an effective global assessment. There is widespread recognition that an assessment of the oceans is needed that will have the impact and status of the IPCC report on climate change.

Some countries are undertaking national assessments of the marine environment that include biodiversity data, and these will make important contributions to global assessments. Thus according to the CBD 3rd reports:

- 20% of responding Parties reported that they are planning comprehensive assessments of marine and coastal ecosystems
- 22% of responding Parties report that comprehensive assessments are in progress, including Brazil and China (initiated monitoring of national offshore marine ecology in 2004, and established 15 ecological monitoring areas);
- 31% of responding Parties have identified critical ecosystem components including India (assessment of critical habitats completed and databases developed), and Lebanon (assessment of marine and coastal biodiversity undertaken as part of its Biodiversity Country Study);
- 16% of responding Parties reported that management plans for important components of marine and coastal ecosystems are in place, including Israel (rare and threatened ecosystems identified, including aquatic ecosystems and the sand and kurkar rocks along the Mediterranean shoreline).

It will be important to ensure that the production of the GMA does not lead to duplication of activities and the development of parallel processes; key needs at present are for:

- Better harmonization of the many reports, reviews and assessments that are being produced by international organizations such as UNEP, FAO, IUCN, the Global Forum and the CBD.
- Improved reporting by Parties to the CBD in their periodic national reports, so that more comprehensive, standardised information is provided that can be used for global assessments.

5. Conclusions and Recommendations

This overview of progress in meeting the WSSD commitments on conserving marine biodiversity and establishing MPAs reveals a mixed picture. There would appear to be a growing recognition of the value and importance of conserving marine biodiversity, evidenced perhaps by the number of initiatives in recent years on MPAs and their networks as well as work on marine management and assessment, although the base starting point was low. In some countries a framework for action is in place that facilitates country level actions; there are also regional frameworks such as the Regional Seas conventions and initiatives such as the Caribbean and Micronesia Challenges; and the CBD with its marine and coastal programme provides the overall global framework, with thematic

[72] UNEP (2007) Global Marine Assessments: A survey of global and regional assessments and related activities of the marine environment. UNEP/UNESCO-IOC/UNEP-WCMC.

conventions such as CITES and the Convention on Migratory Species.

At the same time, the fundamental problem remains of adequately mainstreaming biodiversity issues into investment and planning decisions by countries and thus into key sectors such as water, agriculture, fisheries and tourism. In fact, in some countries reversals have occurred such as in the Dominican Republic where an MPA was reduced in size to make way for commercial development. There would also appear to be a particular need for improved research, knowledge and assessment of marine biodiversity. Conservation of marine biodiversity in areas beyond national jurisdiction presents a further and to some extent different set of problems and challenges.

Until the underpinning value of marine biodiversity to these and other sectors is understood and explicitly valued, then it is unlikley that the rate of decline in marine biodiversity can be reduced. The various initiatives on MPAs can be seen as a vehicle towards changing this perception, even if such initiatives also need to be placed within wider management frameworks, such as integrated coastal zone management and ecosystem management generally. The value of these MPA initiatives is that as well as providing a direct mechanism to address biodiversity protection, they provide a vehicle for engagement on biodiversity issues with a wide range of sectors.

Key recommendations

Make marine biodiversity relevant to individuals, governments and the private sector by demonstrating its economic and social value

Quantifying the economic and social values of marine biodiversity and marine ecosystem goods and services is essential if politicians and government officials are to be convinced of the need for their protection and management. There are still relatively few examples of such studies, and there is widespread recognition that further work is needed. A recent publication by the CBD[73] highlighted the socio-economic benefits of MPAs in terms of improved fish catches and bigger fish, new jobs, better local governance, improved public health, and empowered women. WRI is assisting the ICRI secretariat to compile information, references, and good examples of economic valuation in practice, with an emphasis on coral reefs. Regional initiatives are also underway such as a research study commissioned by the Western Indian Ocean Marine Science Association to assess the goods and services provided by coastal and marine ecosystems in this region. Successful initiatives that demonstrate the value of marine biodiversity conservation also need highlighting, such as MPAs that have brought local and national benefits in terms of alternative livelihoods and strengthening economic growth, and protection of vulnerable coastal communities that is contributing to adaptation to climate change.

Increase financial support for marine biodiversity conservation

As the financial mechanism of the CBD, the GEF has a central role to play in providing international funding support for the POW. Since the 1990s, over US$600 million of GEF funds have been invested in projects at varying action and technical levels to improve the management of coastal and marine projects, with US$320 million being spent on coral reef, seagrass and mangrove habitats. Other funding agencies, particularly bilateral donor agencies, will need to provide significant additional funding for marine biodiversity, in particular MPAs (for example, there has been a movement to establish trust funds to pay for the set up and operation of networks of MPAs). An on-going donor forum is required to further strengthen the implementation of relevant programme of works under the CBD. In the private sector, the tourism industry is a natural partner in establishing and maintaining MPAs, and industries may be able to

[73] Mulongoy, K.J. and S.B. Gidda (2008). *The Value of Nature: Ecological, Economic, Cultural and Social Benefits of Protected Areas*. Secretariat of the Convention on Biological Diversity, Montreal, 30 pages.

contribute in various ways[74]. Building strong partnerships among governments, donors, international NGOs and the private sector will increase opportunities to create synergies in addressing funding constraints through concerted efforts. Adequate and long-term financial and logistic resources for developing countries are needed to undertake long-term management programmes, rather than the 3 to 5 year funding cycle of projects.

Build capacity by increasing access to suitable tools, guidelines, and lessons learned

Effective implementation of global commitments on marine biodiversity and MPA networks requires mobilization of adequate technical support, in terms of tools, guidelines, knowledge and experiences, and human capacity. Sub-regional capacity building workshops convened in 2007 by the CBD Secretariat and POWPA Friends identified some useful ways of providing technical support that may be relevant in the marine context, including:

- Direct exchange of experts and officials for short-term period to learn specific tools and approaches; use train-the-trainers and peer-to-peer exchanges as low cost mechanisms to ensure that capacity building is self sustaining.

- Practitioner clinics that bring in various experts on a specific topic to help address key challenges and obstacles, and to provide direct training; Increased awareness of the benefits of and rationale for MPA systems is needed in order to gain support from all stakeholders, including MPA practitioners, policy makers, international organizations, NGOs, research institutes and the public. Lessons learned in developing MPA systems should be shared between regions and countries, and existing guidelines and advice should be disseminated more widely and pro-actively. TNC is playing a lead role in this through its 'Marine Learning Group' comprising some 30 representatives of MPAs around the world. Further training work of this nature is needed on a global scale.

- Networks of MPA practitioners should be set up to facilitate the sharing of experiences, challenges and successes amongst regions. Technical support networks involving a group of individuals and organizations committed to sharing information and peer-reviewing their progress on a specific theme or objective over time. For example, IUCN-WCPA with over 8000 protected area practitioners in different regions can play an important role in coordinating regional technical support networks. Such networks can be instrumental in providing technical support, making tools and guidance available, sharing information and knowledge in achieving targets for marine biodiversity and networks of MPAs. While there is considerable progress in developing available tools and guidelines on key activities and principles, such as ecosystem-based approach or integrated coastal management, the accessibility to these available tools are limited as most of them exist only in English. Thus, in addition to continuous efforts to develop new tools and guidelines, better organization and accessibility of existing tools in a range of languages are urgently needed.

According to the CBD 3rd national reports, 25 countries are providing training and career opportunities for marine taxonomists and ecologists. There is a need for all countries and relevant organizations to collaborate to build the capacity necessary to monitor, manage for sustainable use and where appropriate protect marine biodiversity; this may require specialized training, participation in research, and regional and subregional collaborative initiatives.

[74] Protected Areas in Today's World: Their Values and Benefits for the Welfare of the Planet. CBD Technical Series 36

Mainstream the marine biodiversity agenda into all coastal and ocean plans by establishing Friends of the Jakarta Mandate

As has been indicated by Parties to the CBD, mainstreaming the biodiversity agenda into sectoral (e.g. fishery, shipping, other maritime industries) and integrated (e.g. coastal area development plans) development planning initiatives is still a key challenge, given the complexity and cross-sectoral nature of ocean and coastal management. Strong political leadership and commitment are critical for effective mainstreaming. In turn, political commitments can be greatly enhanced through continuous and systematic efforts to raise public awareness of the value of marine and coastal ecosystem and biodiversity components. There is a real need to bring together national economic planners, tourism planners and other leaders from different oceans sectors to exchange information on how to create economic growth while fostering marine biodiversity conservation, and in so doing raise the need for integrated marine and coastal management planning, as well as the work of the Regional Seas conventions

One option might be to establish an informal partnership mechanism for the implementation of the Jakarta Mandate ("Friends of the Jakarta Mandate") in association with the Global Forum. This could be used to renew the commitments made by global leaders at the 2002 WSSD to implement the 1995 Jakarta Mandate on the Conservation and Sustainable Use of Marine and Coastal Biological Diversity of the CBD by mobilizing partnerships. The informal consortium established for POWPA - POWPA Friends - provides an example of how such partnerships can create significant impacts within a short period of time. Friends of Jakarta Mandate could:

- Support the implementation of POW on marine and coastal biodiversity
- Contribute to the preparation of in-depth review of Marine and Coastal POW by providing necessary expertise, information, and resources
- Assist Parties in building capacity
- Promote and market marine biodiversity value
- Facilitate building effective reporting and monitoring framework

Such a consortium could help to strengthen the national reporting mechanism for CBD and other international bodies that helps Parties to contribute data on marine biodiversity trends and MPA status to the global centers and databases (e.g. WDPA, WCPA-Marine, ReefBase, GCRMN) for analysis, and that ensures good dissemination of the results and benefits to all those involved from provision of better data on trends. It could also promote partnership work on key issues (e.g. coral reef and mangrove monitoring and management through organizations such as Reef Check/GCMRN) and support opportunities and funding for activities that increase the exchange of information and lessons learned among the marine conservation community so that progress toward the 2010 biodiversity /2012 MPA targets accelerates.

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Acronyms

CBD	Convention on Biological Diversity
CoML	Census of Marine Life
CI	Conservation International
COP	Conference of the Parties
GCRMN	Global Coral Reef Monitoring Network
GMA	Global Marine Assessment
GMSA	Global Marine Species Assessment
HSMPA	High Seas Marine Protected Area
ICRAN	International Coral Reef Action Network
ICRI	International Coral Reef Initiative
IUCN	International Union for the Conservation of Nature
LME	Large Marine Ecosystem
MPA	Marine protected area
POW	Programme of Work
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SSC	Species Survival Commission
TNC	The Nature Conservancy
UNEP-WCMC	UNEP World Conservation Monitoring Centre (UNEP-WCMC)
UNEP RSP	UNEP Regional Seas Programme
UNGA	United Nations General Assembly
WCPA	World Commission on Protected Areas
WDPA	World Database of Protected Areas
WRI	World Resources Institute
WSSD	World Summit on Sustainable Development

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