UNEP

CBD

Convention on Biological Diversity

Distr.
GENERAL

UNEP/CBD/SBSTTA/14/INF/2
14 April 2010

ORIGINAL: ENGLISH

SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE
Fourteenth meeting
Nairobi, 10-21 May 2010
Item 3.1.3 of the provisional agenda*

REPORT ON IMPLEMENTATION OF THE PROGRAMME OF WORK ON MARINE AND COASTAL BIOLOGICAL DIVERSITY

Note by the Executive Secretary

I. BACKGROUND

1. The Conference of the Parties to the Convention on Biological Diversity indicated, in annex I to decision VII/5, that the elaborated programme of work on marine and coastal biodiversity would be effective for a six-year time period (2004-2010) at which point its implementation would be reviewed in depth, and the programme of work revised, as necessary.

2. In the annex to decision VII/31, the Conference of the Parties decided to undertake the in-depth review of the programme of work on marine and coastal biological diversity at its tenth meeting. The review will be undertaken in accordance with guidelines provided in annex III to decision VIII/15.

3. In order to facilitate this review, the CBD Secretariat, with kind support from the UNEP Division of Environmental Policy Implementation (DEPI), has prepared this document based on compilation and synthesis of information submitted by Parties, other governments and organizations through national and voluntary reports (CBD Notification 2008-095, 30 July 2008), as well as from other appropriate sources. The draft document was circulated to Parties, other Governments and relevant organizations, including indigenous and local communities, for the peer review on 20 August 2009 (CBD Notification Ref. No. 2009-099). Upon incorporating comments submitted from the peer-review process and further revision, the document was finalized and used for the preparation of a pre-session document (UNEP/CBD/SBSTTA/14/4) on the in-depth review of progress made in the implementation of the programme of work on marine and costal biodiversity, which is submitted to the fourteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 14). The results of this compilation and synthesis also provided inputs to the preparation of the third edition of the Global Biodiversity Outlook (GBO-3).

4. The present document is organized in three main sections. The first section provides a brief update on the global status and trends of marine and coastal biodiversity, focusing on selected ecosystems

* UNEP/CBD/SBSTTA/14/1

/...

and species. This section also summarizes the status of the global 2010 sub-targets related to marine and coastal biodiversity. The second section reviews the implementation of the programme of work at the national, regional and global levels. It summarizes actions taken by Parties, other governments and regional and international organizations to implement the programme of work. The section is organized in six chapters corresponding to the programme elements of the programme of work on marine and coastal biological diversity. These chapters are (i) implementation of integrated marine and coastal area management (IMCAM); (ii) marine and coastal living resources; (iii) marine and coastal protected areas; (iv) mariculture; (v) invasive alien species; and (vi) general. The third and final sections review main barriers to implementation of the programme o**f** work and priorities for capacity building to address these barriers.

II. GLOBAL STATUS AND TRENDS OF MARINE AND COASTAL BIODIVERSITY

5. In order to understand whether activities in the programme of work on marine and coastal biological diversity are having the desired effect, it is essential to assess the status and trends of biodiversity in the world's coasts and oceans. The first section of this chapter will summarize status and trends for selected ecosystems and species, while the second section will focus on the 2010 sub-targets related to marine and coastal biodiversity.

A. Status of coastal areas

1. Estuaries and other coastal areas

6. 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[1] of the magnitude and causes of ecological change in 12 estuaries and coastal seas[2] in Europe, North America, and Australia from the onset of human settlement to the present day, using paleontological, archaeological, historical and ecological records to trace changes in important species, habitats, water quality parameters and species invasions. The primary cause of estuarine damage is human exploitation, which has 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, easily accessible diadromous species (fish that migrate between fresh and salt water) were depleted first. Oysters were the first invertebrate resource to degrade due to their value and accessibility as well as destructive harvesting methods in some areas. Human impacts have also destroyed over 65% of seagrass and wetland habitat, degraded water quality and accelerated species invasions.

7. According to the study cited above, the structure and functioning of estuarine and coastal ecosystems has been fundamentally changed by the loss of large predators and herbivores, spawning and nursery habitat, and filtering capacity that sustains water quality. The erosion of diversity and complexity has slowly undermined resilience, giving way to undesirable algal blooms, dead zones, disease outbreaks, and invasions, and elevating the potential for disaster. Although declines in large vertebrates and habitat-providing species have slowed in the last 50 to 100 years, trends in invertebrates and other small animals, water quality, and species invasions continue to deteriorate. Despite some extinction, most species and functional groups persist, albeit in greatly reduced numbers. Thus, the potential for recovery remains, and where human efforts have focused on protection and restoration, recovery has occurred, although often

1 Duarte, C.M. (2002). The future of seagrass meadows. Environmental Conservation 29: 192-206

2 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 seas. Science 23 (312) 5781: 1805-1809.

with significant lag times[3]. Sea-level rise may present the greatest future threat for coastal ecosystems, such as tidal wetlands and beaches[4].

2. Mangroves

8. Global mangrove cover is 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 ha covering the planet in 1980. The rate of net loss appears to have slowed recently but is still high: about 185,000 ha were lost every year in the 1980s, but annual rate of loss in the years 2000-2005 was about 102,000 ha[5]. According to a meeting of world mangrove experts in 2006, the loss of mangroves at 1-2% per year worldwide is greater than or equal to declines in adjacent coral reefs or tropical rainforests. Any further decline in mangrove area is likely to be followed by accelerated functional losses, which might result in the prospect of a world deprived of the services offered by mangrove ecosystems, perhaps within the next 100 years[6]. The major causes of mangrove decline are conversion to aquaculture, agriculture, and urban, residential and tourism development, mainly due to a lack of understanding of the importance of their supply of essential ecosystem services including, for example, coastal protection and stabilisation, nutrient provision, and nursery protection for fish.

9. The loss of mangrove forest threatens mangrove-dependent animals, including birds, reptiles, mammals and amphibians. A global assessment of terrestrial vertebrate species that are restricted to mangrove ecosystems found that 40% of assessed mangrove-endemic vertebrates are globally threatened[7]. However, our knowledge is still incomplete, as only 27 of the approximately 69 terrestrial vertebrates that are dependent on mangroves have been assessed by the IUCN, and 13 of those are classified as threatened on the IUCN Red List[8].

10. Attention to this ecosystem has grown since the 2004 tsunami, which raised awareness of the value of mangroves, particularly in terms of shore protection and as defence against storms. Regarding storm protection, a study conducted in India found that villages shielded from a super-cyclone storm surge by mangrove forests experienced significantly fewer deaths than villages that were less protected[9]. The growing attention on the value of mangroves has precipitated conservation and restoration efforts. 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 associated biodiversity contained in original mangrove forests.

11. Additional global information on mangroves should be available in late 2009 or early 2010 when UNEP-WCMC releases the revised edition of the World Atlas of Mangroves. This information will be

---

3 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 seas. Science 23 (312) 5781: 1805-1809.

4 Global Biodiversity Outlook 3 (GBO-3)

5 FAO (2007) The World's Mangroves 1980-2005. FAO Forestry Paper 153, FAO, Rome

6 Duke et al (2007) A world without mangroves? Science, Vol 317, No. 5834, pp. 41 – 42. Online at http://epic.awi.de/Publications/Duk2007a.pdf

7 Luther, D.A. and Greenberg, R. (2009) Mangroves: A Global Perspective on the Evolution and Conservation of Their Terrestrial Vertebrates. BioScience: Vol. 59, No. 7: 602–612.

8 American Institute of Biological Sciences (2009, July 7). Mangrove-dependent Animals Globally Threatened. *ScienceDaily*. Retrieved December 11, 2009, from http://www.sciencedaily.com /releases/2009/07/090701082905.htm

9 Duke University (2009, April 21). Mangrove Forests Save Lives In Storms, Study Of 1999 Super Cyclone Finds. *ScienceDaily*. Retrieved December 11, 2009, from http://www.sciencedaily.com /releases/2009/04/090414172924.htm

welcome in confirming whether the rate of loss in mangrove cover is still slowing from 2005 to 2010 and by how much (2005 is the last year currently covered by the FAO data).

B. Status of marine shallow water areas

1. Coral reefs

12. Based on analyses undertaken by the Economics of Ecosystems and Biodiversity (TEEB) project, the value of coral reefs to humankind is between US$130,000 and $1.2 million per hectare, per year. These calculations take into account the services provided by coral reefs in relation to food, raw materials, ornamental resources, climate regulation, moderation of extreme events, waste treatment, water purification, biological control, cultural services (including tourism), and maintenance of genetic diversity[10].

13. According to the Global Coral Reef Monitoring Network (GCRMN), estimates assembled through the expert opinions of 372 coral reef scientists and managers from 96 countries are that the world has effectively lost 19% of the original area of coral reefs; 15% are seriously threatened with loss within the next 10-20 years; and an additional 20% are under threat of loss in 20-40 years. The latter two estimates have been made under a "business as usual" scenario that does not consider the looming threats posed by global climate change or that effective future management may conserve more coral reefs. However, 46% of the world's reefs are regarded as being relatively healthy and not under any immediate threats of destruction, except from global climate change. The magnitude and timing of those impacts are as of yet uncertain. These predictions carry many caveats.

14. 2005 was the hottest year in the Northern Hemisphere since 1998 and this resulted in massive coral bleaching and hurricanes throughout the wider Caribbean in 2005 killing up to 90% of corals at certain sites and further damaging their reefs. Consequent surveys in 2006 and thereafter indicated that reefs had not fully recovered, with many countries reporting losses of up to 50% of their previous coral cover. Chronic human stresses, previous bleaching episodes and hurricanes have also deteriorated coral reefs in many places, though some areas have fared better than others.

15. However, coral reefs in the Indian Ocean, especially in the Seychelles, Chagos and the Maldives, and Palau in the Western Pacific, have continued to recover from the devastating bleaching of 1998.

16. Degradation of coral reefs near major human population centres continues, with losses of coral cover, fish populations and probably biodiversity in general.

17. There is increasing evidence that global climate change is having direct impacts on more and more coral reefs with clear evidence that rising ocean acidification will cause greater damage into the future. A recent research paper predicts that at today's atmospheric CO_2 levels (~387 ppm), coral reefs are committed to an irreversible decline. Mass bleaching will in future become annual, departing from the 4 to 7 years return-time of El Niño events. Bleaching will be exacerbated by the effects of degraded water-quality and increased severe weather events. In addition, the progressive onset of ocean acidification will cause reduction of coral growth and retardation of the growth of high magnesium calcite-secreting coralline algae. If CO_2 levels are allowed to reach 450 ppm (due to occur by 2030–2040 at the current rates), reefs will be in rapid and terminal decline world-wide from multiple synergies arising from mass bleaching, ocean acidification, and other environmental impacts. Should CO_2 levels reach 600 ppm reefs will be eroding geological structures with populations of surviving biota restricted to refuges. Domino effects will follow, affecting many other marine ecosystems. This is likely to have been the path of great

10 Science Daily: What Are Coral Reef Services Worth? $130,000 To $1.2 Million Per Hectare, Per Year http://www.sciencedaily.com/releases/2009/10/091016093913.htm#at

mass extinctions of the past, adding to the case that anthropogenic CO_2 emissions could trigger the Earth's sixth mass extinction[11].

18. Coral reef declines will have alarming consequences for approximately 500 million people who depend on coral reefs for food, coastal protection, building materials and income from tourism. This includes 30 million who are virtually totally dependent on coral reefs for their livelihoods or for the land they live on (atolls)[12].

19. These findings are consistent with an earlier (2006) report by UNEP-WCMC and UNEP GRID-Arendal[13], highlighting new findings which indicate that the ability of coral reefs to survive in a globally-warming world may crucially depend on the levels of pollution to which they are exposed.

2. Seagrasses

20. Seagrasses cover approximately 0.1 – 0.2% of the global ocean, and are of major importance for biodiversity as habitat for fish, birds and invertebrate species; as a major food source for endangered species such as dugong, manatee and green turtle; and for nutrient cycling and stabilizing sediments. The services seagrasses provide in the form of nutrient cycling are valued at an estimated $1.9 trillion per year, while their support for commercial fisheries is estimated to be worth as much as $3500 ha^{-1} yr^{-1}[14]

21. A recent comprehensive global analysis of the change in areal extent of seagrass populations demonstrates that, since the earliest records in 1879, seagrass meadows have declined in all areas of the globe where quantitative data are available, including both high and low latitudes. The study found that seagrasses have been disappearing at a rate of 110 km^2 yr^{-1} since 1980 and that 29% of the known areal extent has disappeared since seagrass areas were initially recorded in 1879. Furthermore, the rates of decline have accelerated from a median of 0.9% yr^{-1} before 1940 to 7% yr^{-1} since 1990. Seagrass loss rates are comparable to those reported for mangroves, coral reefs, and tropical rainforests and place seagrass meadows among the most threatened ecosystems on earth[15].

22. The declining trends have also been recorded by two global seagrass monitoring programmes: SeagrassNet (www.seagrassnet.org) and Seagrass Watch (www.seagrasswatch.org), as well as in the 2003 UNEP-WCMC World Atlas of Seagrasses. Additionally, smaller scale studies have shown that seagrass beds are undergoing significant declines in both extent and health[16], and these losses are expected to accelerate, particularly in South-East Asia and the Caribbean, as human pressures on the coastal zone grow[17].

23. Seagrass decline is attributed to the immediate impacts of coastal development, dredging activities and growing human populations, including as a result of deteriorating water quality. Storm damage, episodes of wasting disease, ecological degradation and climate change also impact seagrasses.

---

11 J.E.N. Veron et al (2009) The coral reef crisis: The critical importance of <350 ppm CO2. Marine Pollution Bulletin 58: 1428–1436.

12 Wilkinson, C. (2008) Status of coral reefs of the world: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia, 296 p.

13 UNEP (2006) Our Precious Coasts - Marine Pollution, Climate Change and the Resilience of Coastal Ecosystems. http://www.unep-wcmc.org/resources/PDFs/Corals/vitalcoastreport_lr.pdf

14 Waycott, M. et al (2009) Accelerating loss of seagrasses across the globe threatens coastal ecosystems. PNAS vol. 106 no. 30 12377-12381.

15 Waycott, M. et al (2009) Accelerating loss of seagrasses across the globe threatens coastal ecosystems. PNAS vol. 106 no. 30 12377-12381

16 T.J.T. Murdoch, A.F. Glasspool, M. Outerbridge, S. Manuel, J. Ward, J. Gray, A. Nash, K. A. Coates, J. Pitt, J.W. Fourqurean, P.A. Barnes, M. Vierros and S.R. Smith (2006) Sustained, catastrophic mortality in the offshore seagrass meadows of Bermuda. *Marine Ecology Progress Series.*

17 Duarte, C.M. (2002) The future of seagrass meadows. *Environmental Conservation* 29:192-206.

Seagrass losses disrupt important linkages between seagrass meadows and other habitats, and their ongoing decline is likely producing much broader and long-lasting impacts than the loss of the meadows themselves. Improved water quality and habitat remediation have been shown to be effective in restoring the health and extent of seagrass meadows[18].

3. Shellfish reefs

24. Just as coral reefs are critical to tropical marine habitats, bivalve shellfish constitutes the key ecosystem of bays and estuaries, creating habitats for a diversity of plants and animals. Shellfish reefs also provide important services to people and nature by filtering water, providing food and habitat for fish, crabs and birds, and serving as natural coastal buffers from boat wakes, sea level rise and storms[19].

25. Centuries of intensive fisheries extraction exacerbated by more recent coastal degradation have put oyster and other shellfish reefs near or past the point of functional extinction worldwide, in that the ecosystem functions and services provided by the reefs are lost. Oyster reefs are one of, and likely the most, imperiled marine habitat on earth: oyster reefs are in poor condition, having declined more than 90% from historic levels, in 70% of bays and 63% of the world's marine ecoregions. Even more troubling, oyster reefs are functionally extinct (>99% loss of reefs) in 37% of estuaries and 28% of ecoregions. Globally, an estimated 85% of oyster reefs have been lost—even greater than the losses reported for other important habitats including coral reefs, mangroves, and seagrasses. Although oyster reefs are beginning to receive some conservation attention, they remain an obscure ecosystem component and still are vanishing at sometimes alarming rates[20].

26. Many factors have contributed to the profound loss of reefs around the world. These threats continue largely unabated today. They include destructive fishing practices and overfishing that directly alter the physical structure of reefs and health of oyster populations; the increase, incidence and severity of disease and parasite outbreaks due to the translocation of shellfish and introduction of non-native shellfish; coastal development activities such as filling ("land reclamation") and dredging of shipping channels; and upstream activities such as altered river flows, dams, poorly managed agriculture and urban development that impact the quality and quantity of water and sediment. The threats posed by climate change and ocean acidification are likely to increase in the future. Shellfish reefs and beds are essential to the health of marine ecosystems, yet they are almost always solely managed as fisheries rather than in a context of ecosystem approach. Replacement of wild species with non-native shellfish also threatens the biodiversity and viability of shellfish reefs[21].

C. Status of deep sea ecosystems

1. Cold water coral reefs

27. Cold water corals are a taxonomically and morphologically diverse collection of organisms distinguished by their occurrence in deeper and colder oceanic waters. They can form large reefs, or occur singly or in tree-like thickets, and are fragile and easily damaged. Although the entire global extent of cold water coral reefs is not known, they are estimated to cover 284,300 km^2, mainly on the edge of continental shelves or on seamounts. They provide habitat for many fishes and invertebrates and enhance

18 Waycott, M. et al (2009) Accelerating loss of seagrasses across the globe threatens coastal ecosystems. PNAS vol. 106 no. 30 12377-12381

19 Shellfish Reefs at Risk: A Global Analysis of Problems and Solutions www.nature.org/shellfish

20 Shellfish Reefs at Risk: A Global Analysis of Problems and Solutions www.nature.org/shellfish

21 Shellfish Reefs at Risk: A Global Analysis of Problems and Solutions www.nature.org/shellfish

biological diversity of deepwater ecosystems22. Radioactive dating techniques have shown that some living banks and reefs are up to 8000 years old, and geological records indicate that cold-water coral reefs have existed for millions of years. Major reef-forming species include *Lophelia pertusa*, *Madrepora oculata*, *Solenosmila variabilis* and *Oculina varicosa* (ivory tree coral). It is estimated that more than a hundred deep-sea coral and sponge species live in the North Pacific off Alaska, at least 34 of which are corals. Researchers estimate that roughly 800 species of stony corals alone have yet to be discovered23.

28. Many cold water coral reefs have been damaged by bottom fishing activities, but the extent of this damage has not been quantified. Most of the reefs studied thus far show physical damage from trawling activities.Because of their vulnerability to damage from bottom trawling, and their very slow rate of recovery (decades to centuries as most cold water coral reefs grow slowly), most recent conservation efforts have focused on preventing fisheries damage, although damage from other activities on the ocean bottom (for example energy exploration) and climate change remains a concern. In recent years there has been rapidly increasing awareness about these communities, as well as increase in research and action to protect them24.

29. Ocean acidification presents a potentially serious future threat to cold water coral reefs. Increase in atmospheric carbon dioxide (CO_2) can increase the acidity of seawater through increased CO_2 dissolution. Acidic water de-saturates aragonite in water, making conditions unfavourable for corals to build their carbonate skeletons. Current research predicts that tropical coral calcification would be reduced by up to 54% if atmospheric carbon dioxide doubled. Because of the lowered carbonate saturation state at higher latitudes and in deeper waters, cold-water corals may be even more vulnerable to acidification than their tropical counterparts. Also, the depth at which aragonite dissolves could become shallower by several hundred metres, thereby raising the prospect that areas once suitable for cold-water coral growth will become inhospitable in the future.129 It is predicted that 70% of the 410 known locations with deep-sea corals may be in aragonite-undersaturated waters by 209925.

2. Seamounts

30. Our knowledge of seamounts and their fauna is limited, with only a small fraction of them sampled and virtually no data available for seamounts in large areas of the world, such as the Indian Ocean. Although seamount biodiversity is still poorly understood on a global scale due to lack of sampling and exploration, available research results suggest that seamounts are often highly productive ecosystems compared to adjacent deep-sea areas that can support high biodiversity and special biological communities, including cold-water coral reefs, as well as abundant fisheries resources. Some evidence suggests high levels of endemic species on seamounts, although these levels may vary between individual seamounts, regions and taxa, and may, in some cases, be limited to species with low dispersal ability26.

---

22 Hourigan, T.F. (ed) (2008) The Status of Cold-Water Coral Communities of the World: A Brief Update. In: Wilkinson, C. Status of coral reefs of the world: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia.

23 Secretariat of the Convention on Biological Diversity (2008). Synthesis and Review of the Best Available Scientific Studies on Priority Areas for Biodiversity Conservation in Marine Areas beyond the Limits of National Jurisdiction. Montreal, Technical Series No. 37, 63 pages.

24 Hourigan, T.F. (ed) (2008) The Status of Cold-Water Coral Communities of the World: A Brief Update. In: Wilkinson, C. Status of coral reefs of the world: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia.

25 Secretariat of the Convention on Biological Diversity (2008). Synthesis and Review of the Best Available Scientific Studies on Priority Areas for Biodiversity Conservation in Marine Areas beyond the Limits of National Jurisdiction. Montreal, Technical Series No. 37, 63 pages.

26 Secretariat of the Convention on Biological Diversity (2008). Synthesis and Review of the Best Available Scientific Studies on Priority Areas for Biodiversity Conservation in Marine Areas beyond the Limits of National Jurisdiction. Montreal, Technical Series No. 37, 63 pages.

31. Seamounts are often linked with cold water coral reefs and they also support populations of deep-sea fish. They may be vulnerable because of their geographical isolation, which for some species may indicate genetic isolation. Seamount fish are particularly vulnerable to exploitation due to the fact that they are often long-lived, slow to mature, and produce only a few offspring. Research has shown that seamount fisheries collapse faster and recover slower than non-seamount fisheries. The fisheries on many known seamounts are already overexploited, with the benthic communities seriously damaged by the impact of heavy bottom trawling and other fishing gear. Catches of seamount species rapidly increased in the 1970s and peaked by the early 1990s, by which time it is likely that almost all productive seamounts were accessible to fisheries. It has been suggested that the apparent increase in catch was sustained by serial depletions of previously unexploited and inaccessible stocks[27].

32. The biggest current threat to seamounts comes from unsustainable fishing activities, which may result in serial depletion and reduced genetic diversity of exploited species, as well as damage to benthic communities from bottom fishing activities. Many scientists are cautious about the ability of seamount areas to support intensive exploitation. Other threats include the mining of deep-water corals associated with seamounts for the jewelry trade, bioprospecting, potential future seabed mining related to mineral resources of ferromanganese crusts and polymetallic sulphides (from vents, which may occur at some younger seamounts). Climate change may also present a future threat as seamount community structure may change because of differences in species' thermal preference and changes in ocean current patterns and ocean acidification.[28]

3. Hydrothermal vents

33. Hydrothermal vents are found along all active mid-ocean ridges and back-arc spreading centers. The InterRidge Hydrothermal vent Database lists 212 separate known vent sites and there are likely to be more. Our knowledge about where hydrothermal vents occur, and how extensive they are, is far from complete, as is our knowledge about their biodiversity and ecology. It is known that vent sites support exceptionally productive biological communities in the deep sea, and vent fauna range from tiny chemosynthetic bacteria to tube worms, giant clams, and crabs. 91% of species in and around vents are endemic; micro-organisms predominate and thousands of low-abundance populations account for most of the observed diversity among phyla[29].

34. There have only been very minor known impacts to vents from scientific research. Scientific research may entail physical disturbance or disruption, or the introduction of light into an ecosystem that is naturally deprived of it. A Code of Conduct for the Scientific Study of Marine Hydrothermal Vent Sites is under development, and guidelines for responsible research activity at hydrothermal vents have been put forward by InterRidge (an international coordination mechanism for ridge studies) [30]. It should be noted, though, that both the guidelines and the Code are voluntary measures[31].

35. Mining of polymetallic sulphide deposits associated with vent systems poses a future threat, which is moving closer to becoming a reality, at least within national jurisdictions. Because the extraction of polymetallic sulphide deposits will be relying on new technologies and methods, its impacts are as of

---

27 Secretariat of the Convention on Biological Diversity (2008). Synthesis and Review of the Best Available Scientific Studies on Priority Areas for Biodiversity Conservation in Marine Areas beyond the Limits of National Jurisdiction. Montreal, Technical Series No. 37, 63 pages.

28 Secretariat of the Convention on Biological Diversity (2008). Synthesis and Review of the Best Available Scientific Studies on Priority Areas for Biodiversity Conservation in Marine Areas beyond the Limits of National Jurisdiction. Montreal, Technical Series No. 37, 63 pages.

29 Ibid

30 http://www.interridge.org/IRStatement

31 Secretariat of the Convention on Biological Diversity (2008). Synthesis and Review of the Best Available Scientific Studies on Priority Areas for Biodiversity Conservation in Marine Areas beyond the Limits of National Jurisdiction. Montreal, Technical Series No. 37, 63 pages.

yet unknown. It is expected that the drifting particles produced by deep-sea sulphide mining have the potential to smother, clog, and contaminate nearby vent communities. Organisms surviving these perturbations would be subject to a radical change in habitat conditions with hard substrata being replaced by soft particles settling from the mining plume. Mining could also potentially alter hydrologic patterns that supply vent communities with essential nutrients and hot water. A further problem may arise during dewatering of ores on mining platforms, resulting in discharge of highly nutrient enriched deep-water into oligotrophic surface waters, which can drift to nearby shelf areas. These impacts may extend beyond national jurisdictions into international waters. Because most invertebrate diversity at vents is found in rare species, habitat destruction by mining can be potentially devastating to local and regional populations[32].

D. Status of open ocean (pelagic) areas

1. Status of fisheries

36. According to the FAO, fish provide more than 2.6 billion people with at least 20% of their animal protein intake. This figure includes protein from the total of over 1000 species that were harvested from the world's capture fisheries. An additional 40 million tonnes of fish per year will be required by 2030 [33]. An overall review of the state of marine fishery resources confirms that the proportions of overexploited, depleted and recovering stocks have remained relatively stable in the last 10–15 years, after the noticeable increasing trends observed in the 1970s and 1980s with the expansion of fishing effort. In 2007, about 28 percent of stocks were either overexploited (19 percent), depleted (8 percent) or recovering from depletion (1 percent) and thus yielding less than their maximum potential owing to excess fishing pressure. A further 52 percent of stocks were fully exploited and, therefore, producing catches that were at or close to their maximum sustainable limits with no room for further expansion. Only about 20 percent of stocks were moderately exploited or underexploited. Most of the stocks of the top ten exploited species worldwide, which together account for about 30 percent of the world marine capture fisheries production in terms of quantity, are fully exploited or overexploited. The areas showing the highest proportions of fully-exploited stocks are the Northeast Atlantic, the Western Indian Ocean and the Northwest Pacific. Overall, 80 percent of the world fish stocks for which assessment information is available are reported as fully exploited or overexploited and, thus, are in particular need of effective and precautionary management[34].

37. A recent study on fisheries and associated conservation measures highlights trends based on available data[35]. According to this study, stocks assessed since 1977 have experienced an 11% decline in total biomass globally, with considerable regional variation. Research trawl surveys also showed changes in size structure that are consistent with model predictions: average maximum size declined by 22% since 1959 globally for all assessed communities. These findings are also consistent with the CBD indicator, the marine trophic index, which indicates that fish caught in the sea continue on average to come from a progressively lower position in the food web (see description on marine trophic index, below). The study also found an increasing trend of stock collapses over time, such that 14% of assessed stocks were collapsed in 2007. This estimate is in the same range as figures provided by the FAO, which estimated that 19% of stocks were overexploited and 9% depleted or recovering from depletion in 2007 (see paragraph above).

---

[32] Ibid

[33] FAO (2007) The World's Aquatic Genetic Resources: Status and Needs. Background document CGRFA-11/07/15.2 for the Eleventh Regular Session of the Commission on Genetic Resources for Food and Agriculture. ftp://ftp.fao.org/ag/cgrfa/cgrfa11/r11w152e.pdf.

[34] FAO State of the World Fisheries and Aquaculture 2008

[35] Worm, B. et al (2009) Rebuilding Global Fisheries. Science 325: 578 – 585.

38. The study also documents increasing efforts underway to restore marine ecosystems and rebuild fisheries. In 5 of 10 well-studied ecosystems, the average exploitation rate has recently declined and is now at or below the rate predicted to achieve maximum sustainable yield. Despite these and other local successes, 63% of assessed fish stocks worldwide still require rebuilding, and even lower exploitation rates (below maximum sustainable yield) are needed to reverse the collapse of vulnerable species. The study believes that the local success stories have shown that recovery of marine ecosystems is possible if exploitation rates are reduced substantially, and that combined fisheries and conservation objectives can be achieved by merging diverse management actions, including catch restrictions, gear modification, and closed areas, depending on local context. For small-scale fisheries, successful forms of governance have involved local communities in a co-management arrangement with government or nongovernmental organizations. Impacts of international fleets and the lack of alternatives to fishing complicate prospects for rebuilding fisheries in many poorer regions, highlighting the need for a global perspective on rebuilding marine resources[36].

2. Status of spawning aggregations

39. More than three quarters (79%) of the known fish spawning aggregations around the world show declining fisheries catches[37]. Of the known Indo-Pacific aggregations, 44% are either in decline or no longer exist. In the Wider Caribbean, 54% of aggregations have declined or been eliminated, with just a few sites where aggregations are stable or increasing. Only a few of the known fish aggregations are protected.

E. Dead zones

40. One of the global trends of the past years had been an increase in the number of dead zones (hypoxic or oxygen deficient areas), which went up from 149 in 2003 to over 200 in 2006. Dead zones are usually caused by pollutants from urban and agricultural sources, which are also predicted to increase, leaching into coastal waters. Most dead zones, a few of which are natural phenomena, have been observed in coastal waters, which are also home to the primary fishing grounds[38]. Figure 1 illustrates the distribution of the known dead zones around the world.

36 Worm, B. et al (2009) Rebuilding Global Fisheries. Science 325: 578 – 585.

37 Data from the Society for the Conservation of Reef Fish Aggregations (SCRFA)

38 Nellemann, C., Hain, S., and Alder, J. (Eds). February 2008. In Dead Water – Merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds**.** United Nations Environment Programme, GRID-Arendal, Norway, www.grida.no

Figure 1: Dead zones (hypoxic i.e. oxygen deficient water) in the coastal zones are increasing, typically surrounding major industrial and agricultural centers (Source: UNEP).

F. Marine species

41. The Marine Living Planet Index tracks trends in a population of 341 representative marine species in 4 oceans from 1970 to the present time. The Marine Living Planet Index shows an average overall decline of 14 per cent between 1970 and 2005 (figure 2). The index is calculated by WWF and partners with data from in 1,175 populations of 341 marine species[39].

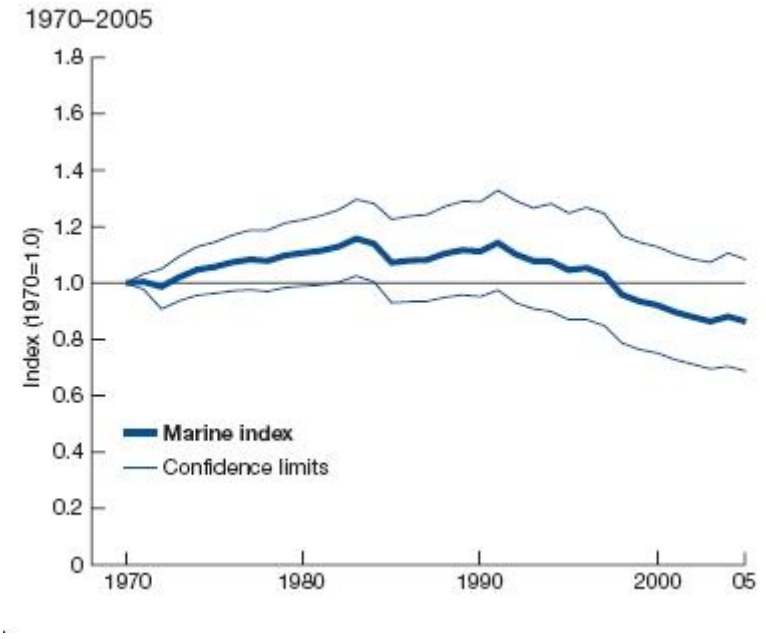


Figure 2: The Marine Living Planet Index shows an average -14 per cent trend over 35 years in 1,175 populations of 341 marine species[40].

G. Seabirds and shorebirds

42. Indicators have documented threats to, and decline in, coastal and seabird populations. According to the Red List Index (RLI), which is based on IUCN's reporting on risk of extinction, seabird species face especially steep decline in survival chances in marine and coastal ecosystems (see figure 3). Similarly, the Shorebird Population Status Index, developed to measure the effectiveness of protection of sites covered by the Ramsar Convention on Wetlands, seems to confirm the finding of the Red List Index that birds are especially threatened in coastal and marine ecosystems. The index finds that the decline in population status for shorebirds between the mid 1990s and the mid 2000s was 2.64 times greater than that for the previous decade. In other words, the global rate of biodiversity loss among this group of

39 WWF–World Wide Fund For Nature (2008) The Living Planet Report 2008. http://assets.panda.org/downloads/living_planet_report_2008.pdf

40 WWF–World Wide Fund For Nature (2008) The Living Planet Report 2008. http://assets.panda.org/downloads/living_planet_report_2008.pdf

species more than doubled in the past 10 years. The declines were especially severe in the East Asian Australasian Flyway (EAAF) and Pacific Flyway[41].

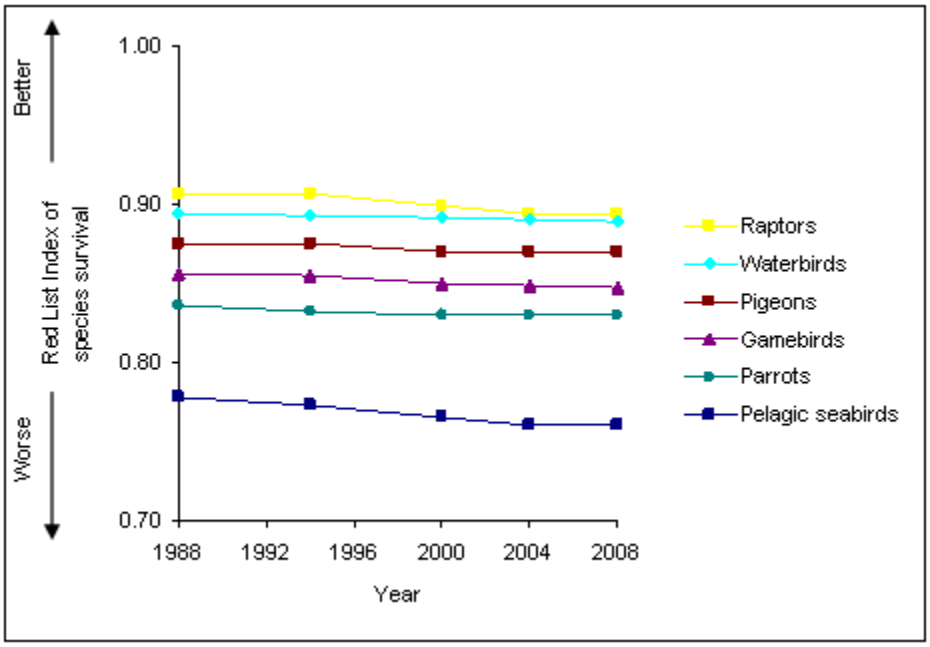


Figure 3: Seabirds are more threatened and declining faster than other groups of birds: Red List Index (RLI) of species survival for bird species in different species groups (n = 311 non-Data Deficient raptors, 826 waterbirds, 304 pigeons, 286 gamebirds, 355 parrots and 192 pelagic seabirds), showing the proportion of species expected to remain extant in the near future without additional conservation action. Analysis of data held in BirdLife's World Bird Database (2008).

43. The status and trends of albatross breeding populations are well documented and, with 18 of 22 species now globally threatened and the remainder Near Threatened, albatrosses have become the bird family most threatened with extinction. Many petrel species are also globally threatened. Although albatross and petrel species face many threats at their breeding sites, the main problems they encounter currently relate to the marine environment, particularly involving interactions with fisheries, notably the many thousands of birds killed annually by longline fishing. Some of the world's richest longline fishing grounds coincide with key foraging areas for vulnerable seabird species. Even a partial overlap between foraging and fishing areas is significant, since small increases in albatross mortality can have severe effects on these long-lived birds[42]. Other major threats to seabirds include invasive alien species, climate change and severe weather, hunting, pollution and human disturbance.

H. Invasive species

44. The number and severity of outbreaks and infestations of invasive species is growing, with dramatic effects on biodiversity, biological productivity, habitat structure and fisheries. Heavily disturbed and damaged marine areas are more likely to be vulnerable to invasive alien species, and their geographical distribution suggests a strong relationship between the occurrence of invasive species and disturbed, polluted and overfished areas, and in particular the location of major shipping routes at a global scale. It appears that the most devastating outbreaks of marine invasive alien species have occurred along the major shipping routes. The growing effects of climate change will most likely further accelerate these

41 Draft GBO-3

42 BirdLife International (2008) *State of the world's birds: indicators for our changing world.* Cambridge, UK: BirdLife International.

invasions and increase the likelihood of invasions by other species. One example of a recent marine invasion is the Indo-Pacific lionfish, which is rapidly invading the waters of the Caribbean, and has the potential to drastically threaten coral reef fishes with serious consequences to the entire ecosystem. Figure 4 shows the locations of major problem areas for invasive species[43].

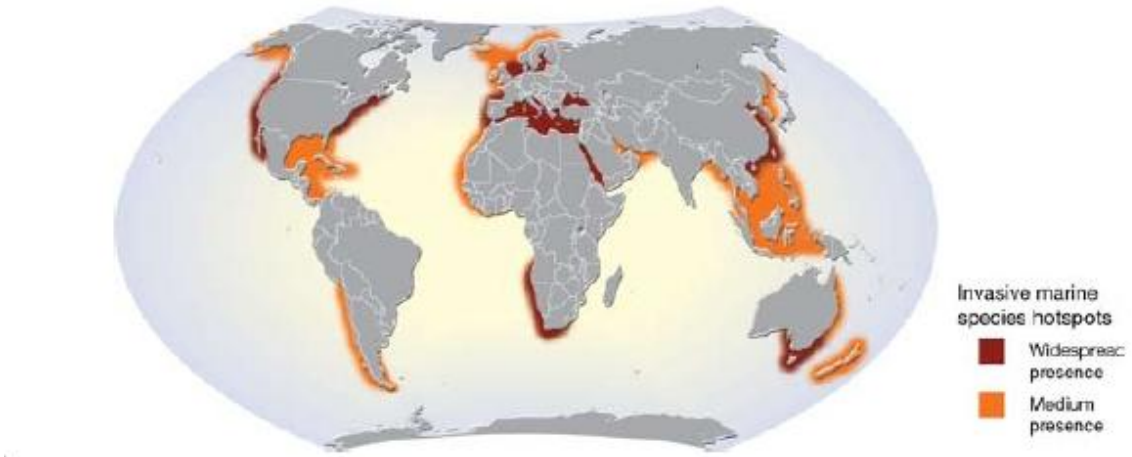


Figure 4: The locations of major problem areas for invasive species. (Source: UNEP)

I. Pressures on the marine biodiversity and future trends

45. In general, pressures on coastal and marine biodiversity are increasing. 50% of the world's population will live along the coasts by 2015, putting coastal resources under mounting pressures. This rising population and the associated coastal development will likely cause an increase in marine pollution, more than 80% of which originates from land-based sources[44]. An increase in the loads of sediments and nutrients discharging into the coastal zone will diminish the resilience of biodiversity in these areas. Rising populations will also place additional pressures on mangroves and other coastal vegetation. Projections from UNEP estimate that as much as 91% of all temperate and tropical coasts will be heavily impacted by development by 2050. These impacts will be further compounded by sea level rise and the increased frequency and intensity of storms that easily break down weakened or dead corals and are likely to severely damage beaches and coast lines[45].

46. These human pressures will combine with the impacts of climate change, which will become more severe in the future. Sea water temperature increases will cause more frequent and severe coral bleaching events. Rising CO_2 concentrations in the atmosphere will result in sea water becoming more acidic, reducing the biocalcification of tropical and cold-water coral reefs, as well as other shell-forming organisms, such as calcareous phytoplankton, impacting the entire marine food chain. In addition, climate

43 Ibid.

44 UNEP GPA: http://www.gpa.unep.org/

45 Nellemann, C., Hain, S., and Alder, J. (Eds). February 2008. In Dead Water – Merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds**.** United Nations Environment Programme, GRID-Arendal, Norway, www.grida.no

change may affect ocean circulation, including potentially reducing the intensity and frequency of large scale water exchange mechanisms, impact both nutrient and larval transport and increase the risk of pollution and dead zones[46]. Serious concerns over potential impacts of climate change and ocean acidification are highlighted, *inter alia*, in the findings of the CBD report on ocean acidification (CBD Technical Series 46 on the Scientific Synthesis of the Impacts of Ocean Acidification on Marine Biodiversity), CBD Ad Hoc Technical Expert Group on Biodiversity and Climate Change, the Interacademy Panel Statement on Ocean Acidification, the Tromsø Declaration of the Arctic Council, and the recent CBD studies on the biodiversity impacts of ocean acidification and ocean fertilization, as well as in scientific literature.

47. A recent (July 2009) statement of the Coral Reef Crisis Working Group Meeting, organized by the Zoological Society of London, the International Programme on the State of the Ocean (IPSO) and the Royal Society indicated that proposals to limit CO_2 levels to 450ppm will not prevent the catastrophic loss of coral reefs from the combined effects of global warming and ocean acidification, and that to ensure the long-term viability of coral reefs the atmospheric CO_2 level must be reduced significantly below 350ppm[47]. The message in this statement is similar to that in the Interacademy Panel Statement on Ocean Acidification (June 2009), which states that with current emission rates models suggest that all coral reefs and polar ecosystems will be severely affected by 2050 or potentially even earlier. Additionally, marine food supplies are likely to be reduced with significant implications for food production and security in regions dependent on fish protein, and human health and wellbeing[48].

48. It is evident from these statements and recent scientific research that the combined actions of climate change and other human pressures will increase the vulnerability of biodiversity, with serious ecological and social consequences. These sobering future predictions are an indication of the quickly escalating pressures on marine and coastal biodiversity, and the equally decisive action towards conservation and sustainable use that is needed to offset the pressures. The series of maps in figure 5, below, provided by the Census of Marine Life, demonstrate what the effects of ocean warming and acidification might mean for the future of coral reefs. As the graphics show, optimal temperature and pH conditions for coral reef calcification have declined from 1880, and conditions are projected to become marginal for most tropical areas by 2065. Cold water coral reefs in temperate areas would encounter very low calcification conditions by this time.

46 Ibid.

47 http://static.zsl.org/files/statement-of-the-coral-reef-crisis-working-group-890.pdf

48 http://www.interacademies.net/Object.File/Master/9/075/Statement_RS1579_IAP_05.09final2.pdf

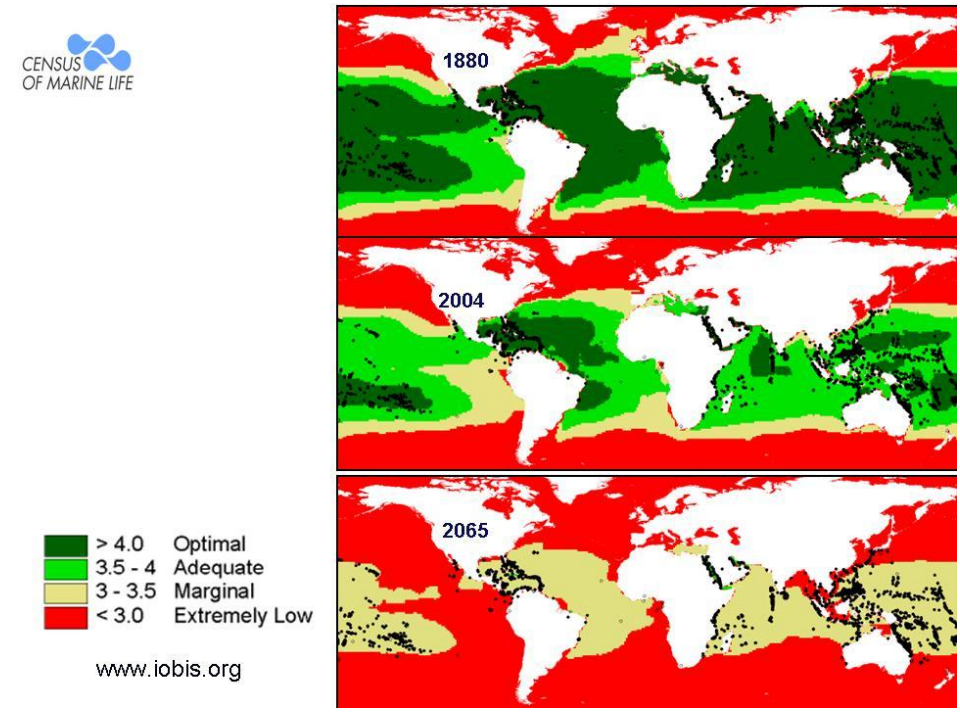


Figure 5: Long-term optimal temperature and pH conditions for coral calcification. The trends show a decline in conditions from 1880 to 2004, and project that by 2065 conditions for calcification will be either marginal or extremely low. Maps provided by the Census of Marine Life.

49. Recent scientific studies have highlighted the critical role that oceans play in maintaining the Earth's climate, including through the global carbon cycle. An estimated 50% of the carbon in the atmosphere that becomes bound or 'sequestered' in natural systems is cycled into the seas and oceans. Oceans not only represent the largest long-term sink for carbon but they also store and redistribute CO_2. Some 93% of the earth's CO_2 is stored and cycled through the oceans. The ocean's vegetated habitats, in particular mangroves, salt marshes and seagrasses, cover <0.5% of the sea bed. These habitats account for more than 50%, perhaps as much as 71%, of all carbon storage in ocean sediments. They comprise only 0.05% of the plant biomass on land, but store a comparable amount of carbon per year, and thus rank among the most intense carbon sinks on the planet[49]. The importance of the oceans in general, and these habitats in particular, present a strong argument towards maintaining or restoring their resilience through management efforts.

Global trends summary

50. Most of the global marine and environmental assessments that have been conducted during the last few years[50] have found serious declines in marine living resources, losses of coastal habitats, elevated pollution levels, poor water quality in many areas, and overall deterioration of the marine environment exacerbated by the effects of climate change. Coastal communities and local economies are adversely impacted by such trends as poverty, land use changes, overfishing, nutrient loading, sewage, and developments, which put the capacity of the marine environment beyond its sustainable limit[51]. While these global trends still point downwards, some good news can be found in the form of local and regional

49 Nellemann, C., Corcoran, E., Duarte, C. M., Valdés, L., De Young, C., Fonseca, L., Grimsditch, G. (Eds). 2009. Blue Carbon. A Rapid Response Assessment. United Nations Environment Programme, GRID-Arendal, www.grida.no

50 E.g. Global Environment Outlook (GEO) Year Book 2007; Global Biodiversity Outlook; Global International Waters Assessment (GIWA)

51 Report of the 4th Global Conference on Oceans, Coasts and Islands, Hanoi, Vietnam, April 7-11, 2008.

success stories, for example in the recovery of Indian Ocean coral reefs from mass mortality in 1998 in areas with low levels of human stress, and in the slowing of the loss of mangrove forests globally. While coral reefs, mangroves and other ecosystems globally continue to be threatened by climate change, pollution, overfishing and other human impacts, these positive trends in the midst of globally declining biodiversity demonstrate that effective management can slow and perhaps eventually halt the loss of biodiversity, and that a reduction in other stress factors, such as pollution, can give ecosystems a better chance to adapt to climate change.

J. Status of the 2010 sub-targets on marine and coastal biodiversity

51. In decision VIII/15 paragraph 13, the Conference of the Parties agreed to review the goals and global outcome-oriented targets integrated into the programmes of work when these are subjected to an in-depth review in accordance with the multi-year programme of work of the Convention. Accordingly, the 2010 sub-targets related to marine and coastal biodiversity are reviewed as part of this document.

52. The table below presents the sub-targets, the relevant activities in the programme of work, as well as our present knowledge about the probability of each sub-target being reached. It should be noted that without current data from global indicators, any forecasts about the targets should be viewed as extremely tentative at best. This section will be revised as better data become available.

53. It should also be noted that the sub-targets were adopted in 2006, only giving countries four years to undertake measures to reach them. Given the short time-frame allowed for implementation, as well as inertia in ecological systems, it is unlikely that most of the targets will be fully attained, even if progress in implementing actions towards conservation and sustainable use is being made.

TARGET	INDICATORS	RELEVANT SECTION OF PoW	WILL THE TARGET BE REACHED
1.1: At least 10% of each of the world's marine and coastal ecological regions effectively conserved.	- Coverage of protected areas - Trends in extent of selected biomes, ecosystems and habitats - Trends in abundance and distribution of selected species	Primarily operational objectives 3.1, 3.2, 3.3, 3.4 and 3.5 Additionally, operational objectives 1.1, 1.2, 2.1, 2.3 and 2.4	It is likely that this target will be met for some ecosystems (e.g. mangroves, coral reefs) and ecological regions but not globally, as only less than 1% of oceans are protected presently. **Current trend:** PARTIAL ACHIEVEMENT
1.2: Particularly vulnerable marine and coastal habitats and ecosystems, such as tropical and cold water coral reefs, seamounts, hydrothermal vents mangroves, seagrasses, spawning grounds and other vulnerable areas in marine habitats	- Trends in extent of selected biomes, ecosystems and habitats - Trends in abundance and distribution of selected species - Coverage of protected areas	Primarily operational objectives 1.2, 3.1, 3.2, 2.3 and 3.2 Additionally operational objectives 3.4, 1.1, 1.3 and 2.1	This target will likely not be reached, even though the protection of coral reefs, seamounts and mangroves is increasing, and there is a reduction in the loss of mangroves (although this trend will need to be confirmed by the new World Atlas of Mangroves, to be published in late 2009 or

effectively protected			early 2010). However, the level of protection is not yet adequate, and there is no effective protection against threats, such as ocean acidification. A great majority of spawning aggregations are unprotected. **Current trend:** LIKELY NOT ACHIEVED
2.1: Reduce the decline of, maintain or restore populations of species of selected marine and coastal taxonomic groups	- Trends in abundance and distribution of selected species - Change in status of threatened species	Primarily operational objectives 2.1, 2.2, 2.3, 2.4, 1.2 and 3.1 Additionally operational objectives 3.2, 3.3 and 1.1	Available data and indicators are not complete, but current data indicate an increase in Red Listed marine species, and a decline in species such as sharks, shorebirds and seabirds. **Current trend:** LIKELY NOT ACHIEVED
2.2: Known globally threatened and endangered marine and coastal species, with particular attention to migratory and transboundary species and populations, effectively conserved	- Change in status of threatened species - Trends in abundance and distribution of selected species - Coverage of protected areas	Same as target 2.2	Same as above (2.1), though there will likely be some success stories. **Current trend:** LIKELY NOT ACHIEVED
3.1: Further losses of known genetic diversity of exploited wild fish and other wild and cultured marine and coastal species prevented, and associated indigenous and local knowledge maintained	- Trends in genetic diversity of fish species of major socio-economic importance - Trends in abundance and distribution of selected species	Primarily operational objectives 2.1, 2.2, 4.1 and 5.2 Additionally operational objectives 1.1, 1.2, 2.4, 3.1 and 3.3	There is not enough information to assess progress towards this target at the present time.
4.1.1: All exploited fisheries products derived from sources that are sustainably managed, and unsustainable uses of other marine and coastal species minimized	- Proportion of fisheries derived from sustainable sources (check status of indicator) - Trends in abundance and distribution of selected species - Marine trophic index - Nitrogen deposition - Water quality in aquatic	Primarily operational objectives 2.1, 2.4 and1.2 Additionally operational objectives 1.1, 3.1, 3.2 and 3.3	There has been no recovery of fisheries globally, and FAO data indicate that 80 percent of the world fish stocks are fully exploited or overexploited. Effects of many high seas fisheries on non-target species, such as seabirds and marine turtles, remains a

	ecosystems		problem. **Current trend:** LIKELY NOT ACHIEVED
4.1.2: All mariculture facilities operated consistent with the conservation of biodiversity and social equity	- Area of mariculture ecosystems under sustainable management (check status of indicator) - Nitrogen deposition - Water quality in aquatic ecosystems	Operational objective 4.1	This target will likely be partially reached, as there has been improvement in mariculture operations in some, though not all, locations. **Current trend:** PARTIAL ACHIEVEMENT
4.3: No species of wild marine and coastal flora and fauna endangered by international trade	- Change in status of threatened species	None directly relevant. Operational objectives 1.1, 1.2, 2.1 and 2.3 are somewhat relevant	There is not enough information to assess progress towards this target at the present time.
5.1: Rate of loss and degradation of natural marine and coastal habitats, in particular mangroves, seagrasses, tropical and cold water coral reefs, seamounts, hydrothermal vents and other important habitats, decreased	- Trends in extent of selected biomes, ecosystems and habitats - Trends in abundance and distribution of selected species - Marine trophic index	Primarily operational objectives 2.3 and 2.4 Additionally operational objectives 1.1 (all activities, particularly a and b), 1.2, 2.1 (all activities, especially c, d, g, h and I), 3.1, 3.2, 3.3 and 4.1	The rate of loss of mangroves and coral reefs has slowed (though this trend needs to be checked with new data from the upcoming World Atlas of Mangroves). Information is lacking for other habitats. Tropical and cold water coral reefs in particular face heavy pressures in the future. **Current trend:** PARTIAL ACHIEVEMENT
6.1: Pathways for major potential invasive alien species in marine and coastal ecosystems controlled	- Trends in invasive alien species	Primarily operational objectives 5.1, 5.2 and 5.3 Additionally operational objective 4.1, activities (a) (vii), (viii), (ix), and (b) and (e)	The ballast water pathway is regulated through the International Convention for the Control and Management of Ships' Ballast Water and Sediments. This convention has not yet entered into force. Other pathways, like hull fouling on commercial and private vessels, have not been controlled, and risks from them are increasing. Species invasions continue in the

			marine environment. **Current trend:** PARTIAL ACHIEVEMENT
6.2: Management plans in place and implemented for invasive alien species that are considered to present the greatest threat to marine and coastal ecosystems, habitats or species	- Trends in invasive alien species	None of the operational objectives explicitly refer to management plans. However, activities (a), (b), (c), (e) and (f) under operational objective 5.3 relate to management of invasive species beyond the control of pathways. Additionally operational objective 4.1, activities (a) (vii), (viii), (ix), and (b) and (e)	There has been an increase in management efforts of marine invasive species, but this is still a new issue for many countries. Species invasions continue in the marine environment. **Current trend:** LIKELY NOT ACHIEVED
7.1: Maintain and enhance resilience of the components of marine and coastal biodiversity to adapt to climate change	- connectivity/ fragmentation of ecosystems	Primarily operational objective 2.3 and specific work plan on coral bleaching (Appendix 1 to decision VII/5), as well as operational objective 3.3. Additionally activities under all programme elements, particularly 1,2 and 3.	Pollution, overfishing and other human impacts erode resilience of ecosystems and species. Management efforts addressing resilience to climate change are still relatively few on a global scale, and there is still much technical debate about how to achieve resilience. **Current trend:** LIKELY NOT ACHIEVED
7.2: Substantially reduce land-based and seabased sources of marine pollution and their impacts on biodiversity	- Nitrogen deposition - Water quality in aquatic ecosystems	Primarily operational objective 1.2 activities (b) and (c). Additionally operational objective 1.1	Efforts such as the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) have made an impact on land-based pollution in some areas. However, population and development pressures continue to rise. **Current trend:** PARTIAL ACHIEVEMENT

8.1: Capacity of marine and coastal ecosystems to deliver goods and services maintained or enhanced	- Water quality in aquatic ecosystems - Marine trophic index - Incidence of human-induced ecosystem failure - Biodiversity used in food and medicine	Primarily operational objectives 1.1, 1.2, 2.1, 2.3, 2.4, 3.1, 3.2 and 3.3. Additionally, all activities in the programme of work	While quantitative information about the trends in goods and services provided by marine ecosystems is not comprehensively available, the decline in many coastal fisheries, coral reefs and shellfish reefs indicates that their capacity to supply goods and services may be compromised. Again, it remains technically unclear how to assess – and hence how to protect – ecosystems' capacity to deliver ecosystem services. **Current trend:** LIKELY NOT ACHIEVED
8.2: Marine and coastal biological resources that support sustainable livelihoods, local food security and health care, especially of poor people, maintained and, where depleted, restored	- Health and well-being of communities who depend directly on local ecosystem goods and services - Biodiversity used in food and medicine	Same as 8.2	With the decline in marine resources, their ability to support sustainable livelihoods globally has diminished, affecting in particular poor people depending on resource-based economies. In addition, the poor will be most vulnerable to the impacts of climate change. However, management activities have produced many local success stories. Marine genetic resources also show potential as pharmaceuticals and other industrial products. **Current trend:** LIKELY NOT ACHIEVED.
9.1: Measures to protect traditional knowledge, innovations and practices associated with marine and coastal biological diversity implemented, and the participation of indigenous and local communities in activities aimed at this promoted		Primarily operational objectives 1.1 (activity i), 2.1 (activities e and h), 2.3 (coral bleaching work plan Appendix 1) and 4.1 (activities a, i and xiii), as well as programme element 3 (goal) and	Not enough information to assess at the present time

and facilitated		preamble of the PoW	
9.2: Traditional knowledge, innovations and practices regarding marine and coastal biodiversity respected, preserved and maintained, the wider application of such knowledge, innovations and practices promoted with the prior informed consent and involvement of the indigenous and local communities providing such traditional knowledge, innovations and practices, and the benefits arising from such knowledge, innovations and practices equitably shared		Same as target 9.1	Not enough information to assess at the present time
10.1: All access to genetic resources derived from marine and coastal biological diversity is in line with the Convention on Biological Diversity	No indicators related to access to genetic resources and benefit-sharing have yet been developed. The issue of ABS indicators is likely to be addressed after COP 10 once the International Regime on Access and Benefit-sharing has been adopted.	None	Not enough information to assess at the present time. However, national Access and Benefit-Sharing (ABS) legislation is becoming more common and an international regime on ABS is currently under negotiation.
10.2: Benefits arising from the commercial and other utilization of genetic resources derived from marine and coastal biological diversity shared with the countries providing such resources	No indicators related to access to genetic resources and benefit-sharing have yet been developed. The issue of ABS indicators is likely to be addressed after COP 10 once the International Regime on Access and Benefit-sharing has been adopted.	None	Not enough information to assess at the present time. However, there are still relatively few examples of benefit-sharing relating to genetic resources from the marine and coastal environment.
11.1: New and additional financial resources are transferred to developing country Parties, to allow for the effective implementation of their commitments for the programme of work on marine and coastal biological diversity under the Convention, in accordance with Article 20	- Official development assistance provided in support of the Convention	None	Not enough information to assess at the present time.

11.2: Technology is transferred to developing country Parties, to allow for the effective implementation of their commitments for the programme of work on marine and coastal biological diversity under the Convention, in accordance with its Article 20, paragraph 4		None	Not enough information to assess at the present time.

III. REVIEW OF THE IMPLEMENTATION OF THE PROGRAMME OF WORK ON MARINE AND COASTAL BIOLOGICAL DIVERSITY

Programme element 1: Implementation of integrated marine and coastal area management

Operational objective 1.1: To apply appropriate policy instruments and strategies, including building of capacity, for the effective implementation of IMCAM

Status and trends in IMCAM implementation

54. Integrated marine and coastal area management is now being applied by a majority of coastal countries in the world. According to the 2005 3rd National Reports, 78.43% of all CBD parties have instituted improved integrated marine and coastal area management (including catchment management) in order to reduce sediment and nutrient loads into the marine environment. This figure is an increase from the 2nd National Reports (submitted by countries in 2002) when only 28% of the responding countries had institutional, administrative and legislative arrangements in place for the development of IMCAM. At that time, however, 58% were developing such arrangements. Even though updated statistics are not available, it is likely that the implementation of IMCAM in its various formats is even greater at the present time. Every coastal country that has submitted a 4th National Report or a voluntary report thus far has reported on some IMCAM-relevant initiatives.

55. A relatively new trend evident in the last set of national and voluntary reports is the development of comprehensive, large-scale (bioregional or large marine ecosystem scale) national and regional IMCAM plans that consider ecosystems, species and habitats, as well as human uses and needs. Such plans are increasingly, though not yet comprehensively, backed by policy and legislation. The difference from coastal management projects of the past is that there is an increasing effort to consider ecosystems in their entirety. As an example, the Parliament of Norway has endorsed the need for integrated management of all maritime areas based on the ecosystem approach. The first management plan was developed for the Barents Sea/Lofoten area and is considered a groundbreaking effort due to its incorporation of integrated, ecosystem-based management[52]. Canada has established and is applying integrated oceans management in Five Large Oceans Management Areas (LOMAs) in Canada's three oceans. The approach includes Integrated Oceans Management Governance and Advisory Bodies, comprehensive assessments of social, economic and ecological characteristics and their corresponding ecosystem-based conservation[53]. Australia has developed science-based bioregional plans, which have proven effective in planning for and

[52] Norway's 4th National Report

[53] Canada's voluntary report on the implementation of the programme of work on marine and coastal biodiversity

implementing IMCAM. Such bioregional plans are useful for a variety of management applications, as well as the protection of biodiversity, as demonstrated in the Australian case study below.

Box 1. CASE STUDY: Australia's Marine bioregional planning process

Under the Australian Marine Bioregional program, Bioregional Profiles have been developed to provide a detailed picture of each of Australia's marine regions including key habitats, species, natural processes, heritage values, and human uses. This information provides a foundation for the development of Marine Bioregional Plans that will guide the Commonwealth and sectoral managers and industry, about the key conservation issues, threats to long-term ecological sustainability and conservation priorities in each marine region. Within the context of the assessment and approval provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the Marine Bioregional Plans will also assist in understanding the impacts of potential actions on the Commonwealth marine environment and assist~~ing~~ decision-making in relation to proposed developments, thereby ensuring integration of biodiversity conservation priorities in activity planning and management.

Marine bioregional planning is also the process through which the Australian Government identifies areas within Commonwealth waters for inclusion in the National Representative System of Marine Protected Areas. Australia's marine protected areas are designed primarily to ensure protection of Australia's marine biodiversity, and are managed through zones targeting strict wilderness conservation to 'multiple-use' consistent with the conservation objectives. Australia has adopted the set of protected area management categories defined by the International Union for the Conservation of Nature (IUCN), which provide consistency in comparing protected areas across Australia.

Extensive stakeholder engagement, including Commonwealth, state and territory government agencies, industry representatives, indigenous communities, researchers and environmental organisations is central to the effectiveness of the system. The structured planning process, use of decision-making guidelines in designing the NSRMPA, and stakeholder engagement in this program assist in providing greater certainty for future marine management and resource use.

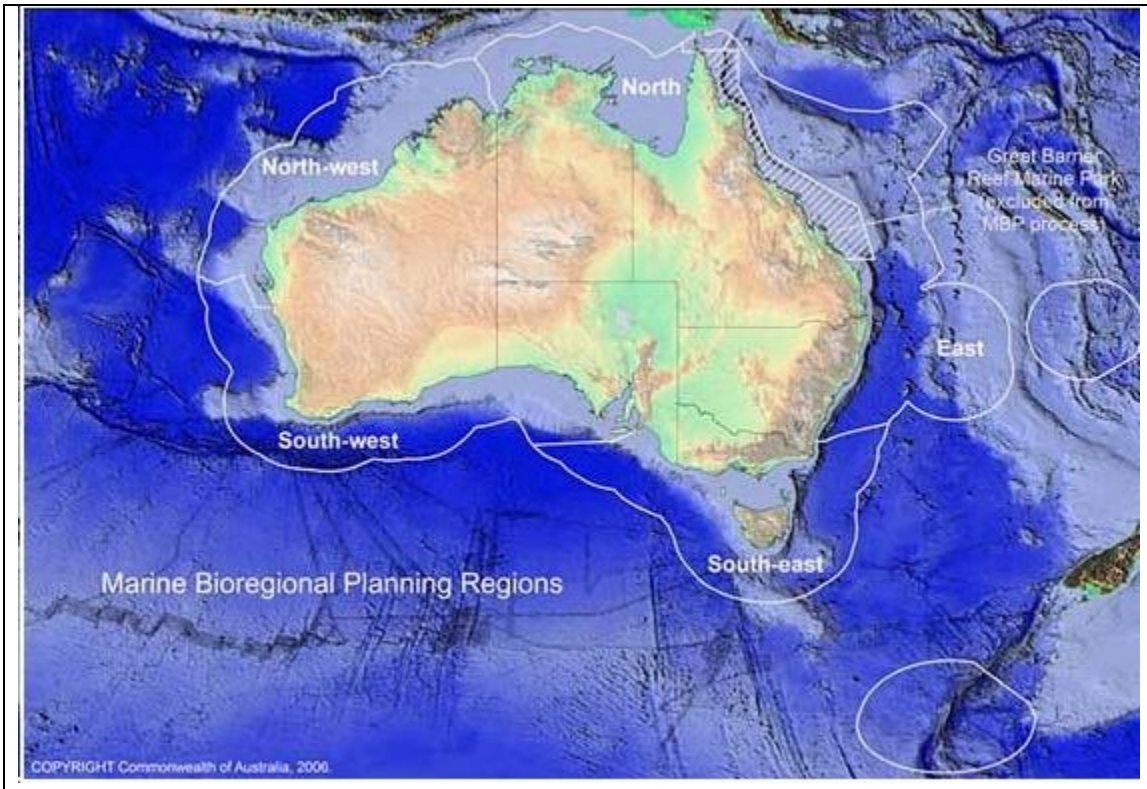


Figure: Australia's marine planning regions.

Source: Australia's voluntary report on the implementation of the programme of work on marine and coastal biodiversity.

56. Other countries and regions are undertaking similar projects for bioregions, ecoregions, and/or large marine ecosystems, often as part of marine spatial planning projects. As defined by UNESCO, marine spatial planning is a public process of analyzing and allocating areas of four-dimensional marine spaces (ecosystems) either by objectives or specific uses (or non-uses) to achieve ecological, economic, and social goals that are usually specified through a political process. Marine spatial planning is consistent with the ecosystem approach in that it is ecosystem-based (taking an integrated approach to management that considers the entire ecosystem, including humans), spatially explicit (analyzing and potentially allocating three-dimensional marine spaces for specific management objectives), and science-based (management decisions are based on the best available information and expertise). It considers and addresses cumulative impacts of relevant policies and multiple current and future human activities that affect ecosystems; encourages transparency and participation; and considers multiple ocean management objectives and sectors.

57. As an example of marine spatial planning, the Baltic countries are collaborating on a project called BALANCE – or in full "Baltic Sea Management – Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning". Like many other places in the world, the Baltic Sea is subject to severe environmental degradation caused by commercial and leisure activities such as dredging, fisheries, tourism, coastal development and land based pollution sources, placing increasing pressures on vulnerable marine habitats and natural resources. Conflicting priorities and lack of integrated management planning was deemed a key obstacle for resolving the current state of affairs. The BALANCE project aims to implement an ecosystem approach to management, based on transnational

spatial planning, which integrates complex information on marine landscapes, habitat distribution, economic values and conservation status with information on user practices and stakeholders dependence on natural resources, in order to achieve holistic planning and informed decision-making[54].

58. Other examples of marine spatial planning include a project in St. Kitts and Nevis, which aims to produce an island wide zoning plan. This process will serve as an example of zoning for other small island states and will help build regional capacity. Participation of communities, private business, NGOs and government agencies is an essential component of this project. A project in Samana Bay, Dominican Republic will develop a draft zoning plan for this area using a participatory approach. The project will also produce a regional spatial database and the use of decision support zoning tools by local and national decision makers and government agencies looking to improve the conservation and sustainable use of marine resources through a consensus-based, stakeholder driven processes among various user groups.

59. A wish to manage multiple uses and achieve conservation objectives has prompted China to develop marine functional zoning in the Chinese Territorial Sea[55], and spatial planning has also been undertaken by Belgium, Norway and Germany. Philippines, Indonesia and Malaysia have collaborated on the management of the Sulu Sulawesi Seas Ecoregion, as described in the box below. The Sulu Sulawesi Seas Ecoregion example highlights the importance of stakeholder involvement in agreeing on common vision and priority actions.

Box 2. CASE STUDY: Management of the Sulu Sulawesi Seas Ecoregion

The Sulu and Sulawesi Seas, also known as the Sulu-Celebes Sea, is a subregion inhabited by 35 million people and spans an area of nearly one million km^2. The seas are located within the Coral Triangle, described as the global center of marine biodiversity. It is home to the Verde Island Passage, which in turn is regarded as the center of marine shorefish biodiversity. The area is identified as a distinct Large Marine Ecosystem (LME) ecoregion, and the countries in the region, Philippines, Indonesia and Malaysia, are in the process of developing and implementing a tri-national partnership arrangement.

Stakeholders of the Sulu and Sulawesi Seas have been able to share information and jointly identify priority areas for conservation to achieve a common vision (see map below). They have crafted a plan known as the Ecoregion Conservation Plan (ECP) for the Sulu-Sulawesi Marine Ecosystem (SSME) and forged a tri-national management mechanism. The three countries, in partnership with local governments, communities, scientific and technical institutions, international NGOs, donors and the business sector, are now in the process of developing the required capacities to implement the ECP, including strengthening environmental law enforcement and exploring sustainable financing mechanisms geared to making the Sulu and Sulawesi Seas a strong example of marine ecoregion management initiatives in the East Asian seas.

54 The voluntary reports of Finland and Sweden on the implementation of the prorgamme of work on marine and coastal biodiversity, as well as the BALANCE website at http://balance-eu.org/

55 4th National Report of China

Figure: Priority areas for conservation in the Sulu Sulawesi Seas area

Source: S.A. Ross (2008) Partnerships at Work. Tropical Coasts, vol. 15, No. 1. http://d130148.u37.wsiph2.com/publications/TC/tc_1501.pdf

60. IMCAM activities are also implemented as part of Large Marine Ecosystem (LME) projects. For example, Ghana reports that **t**he 16 countries in West and Central Africa that border the shoreline of the Gulf of Guinea have agreed on a regional plan to enhance IMCAM, which is expected to be implemented by each country. Ghana has taken serious note of these measures, which are being fully implemented.

61. While these large-scale projects are important for increasing the area of world's oceans and coasts under effective management, smaller sub-national and local projects are equally important for achieving local conservation objectives and effectively working with stakeholders, in particular local communities. The involvement of communities is particularly important where their livelihoods are directly dependent on coastal and marine resources.

62. For example, Cambodia reports that numerous activities related to coastal zone management have been implemented under the Environmental Management of Coastal Zone (EMCZ) project, targeted at education and raising environmental awareness, various community-based resources management initiatives and alternative livelihood pilot programs among others. Through a second phase called the Integrated Coastal Zone Management Project, four coastal resource centers were established in 2005 to function as marine labs to test water quality, to create a database on marine resources, and to serve

research and education purposes. In addition, 600 ha of mangrove forest have been planted, and conservation activities related to mangroves, coral reefs, seagrasses and threatened species have been undertaken.

63. The Philippines has adopted integrated coastal management as the national strategy for the sustainable development of the country's coastal and marine environment and resources. The goal is to achieve food security, sustainable livelihood, poverty alleviation, vulnerability reduction and ecological integrity. IMCAM is being implemented in many coastal and marine areas, addressing the interlinkages among associated watersheds, estuaries and wetlands, and coastal seas, by all relevant national and local agencies, civil society, and the private sector.

64. In Niue, in the South Pacific, integrated coastal watershed management is being undertaken with the help of funding from a GEF International Waters Project. The management approach aims to encourage action at the community level to address priority issues relating to marine and freshwater quality, habitat and community modification and degradation, and the unsustainable use of marine resources.

65. In Argentina, a project titled El Proyecto Protección Ambiental del Río de la Plata y su Frente Marítimo (FREPLATA), aims to prevent and mitigate the degradation of coastal and marine biodiversity, as well as promote sustainable use in the Río de la Plata y Frente Marítimo area. The project has defined objectives, methodologies and expected products for each of the project phases, and a national strategy has been elaborated.

66. Such smaller scale management activities can be scaled up, and used as learning experiences for broader application of IMCAM. An interesting example of scaling up comes from East Asia. Extensive efforts to implement integrated marine and coastal area management initiatives have been undertaken in the framework of the Partnerships for Environmental Management for the Seas of East Asia (PEMSEA). The IMCAM projects developed and implemented by PEMSEA include the establishment of National Demonstration Areas for the development of integrated approaches for marine and coastal management; preparation and adoption of the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA); and efforts to scale up IMCAM programmes on the national level. The box below describes how the demonstration site activities have resulted in important learning experiences and in an expansion of IMCAM efforts.

Box 3. CASE STUDY: PEMSEA Integrated Coastal Management Demonstration Sites – from Demonstration to Replication and Scaling-up

The Seas of East Asia sustain 30 percent of the world's coral reefs and mangroves; produce about 40 percent of the world's fish catch and 84 percent of world aquaculture; and represent one of the world's centers for tropical marine biodiversity. However, the Seas of East Asia are under serious threat from human activities. Integrated coastal management (ICM) has proven to be an effective tool for national and local governments, providing a comprehensive and holistic approach to solving the many conflicting uses of coastal and marine resources. ICM is a process that encourages all stakeholders to plan, develop and implement a management program designed to achieve the sustainable development of coastal and marine resources, as well as adjacent watersheds.

PEMSEA has established eight demonstration sites for implementing ICM, covering a total of 917 km of coastline and 15,118km^2 of land and sea areas. The inherent flexibility of ICM enables it to be re-created and adopted by local communities, as well as larger administrative regions, and to fit the complexity and urgency of issues being addressed. The demonstration sites include Xiamen in the P.R. China; Batangas in the Philippines; Danang in Vietnam; Bali in Indonesia;

Chonburi in Thailand; Sihanoukville in Cambodia; Port Klang in Malaysia; Nampho in DPR Korea; Manila Bay in the Philippines; and Bohai Sea in the P.R. China.

Progress to date include the establishment of functional inter-agency and multi-stakeholder coordinating and management mechanism (e.g., Project Coordinating Committees); adoption by local governments of coastal strategies and coastal strategy implementation plans/strategic environmental management plans for the sustainable development of marine and coastal resources and coastal areas within their jurisdictions; operationalization of strategic action plans by multi-agency and multi-sectoral technical teams, with associated local ICM capacity development, including the development/adoption of coastal land and sea use zoning plans in Xiamen, Batangas (sea use plan), Danang, Bali, Sihanoukville and Bataan; scaling up of ICM practices at 18 ICM parallel sites, which were developed and implemented primarily through local government funding, based on good practices from the ICM demonstration areas; and development, adoption and implementation of a sub-regional mechanism to mitigate the impacts of oil spills on coastal and marine areas.

Learning from the experience of the demonstration sites, 20 other local government units in the region began to replicate the ICM programs. A total of 1,674 km of coastline and 27,508 km^2 of land and sea area have now been covered by ICM, benefiting over 11 million inhabitants.

Source: PEMSEA voluntary report on the implementation of the programme of work on marine and coastal biodiversity and the PEMSEA website at http://pemsea.org/sites

Linking IMCAM with watershed management

67. Of importance to the success of IMCAM activities is creating a linkage between watershed management and management actions taken in marine and coastal areas. This is particularly important because as much as 80% of the pollution load in coastal waters and the deep oceans originates from land-based activities. The major benefit of linked management is the scope it provides to ensure that development activities upstream are planned and implemented with full knowledge of the potential impacts on the ecosystems and economic activities and livelihoods in the coastal and marine areas. However, very often upstream and downstream management and planning are not connected and stakeholders in both areas are not aware of their impact on each other.

68. The linkage between watershed and coastal management has been the focus of a number of recent projects, including the UNEP's Caribbean Environment Programme GEF project titled *Integrating Watershed and Coastal Area Management (IWCAM) in the Small Island Development States (SIDS)* of the Caribbean. In the Caribbean Small Island Developing States (SIDS), high population densities, combined with population growth, urbanization and increased development, particularly residential and tourist resort development, has led to the contamination of underlying aquifers and surface water, and deterioration of coastal water quality. The thirteen participating SIDS are; Antigua & Barbuda, The Bahamas, Barbados, Cuba, Grenada, Dominica, Dominican Republic, Haiti, Jamaica, Saint Kitts & Nevis, Saint Lucia, Saint Vincent & the Grenadines, and Trinidad & Tobago. The length of the Project is 5 years and commenced in the second quarter of 2005. The overall objective of this Project is to strengthen the commitment and capacity of the participating countries to implement an integrated approach to the management of watersheds and coastal areas[56].

69. The Global Forum on Oceans, Coasts and Islands, through its Working Group on Freshwater to Oceans has also stimulated dialogue and the sharing of practical case studies on this topic[57]. In addition,

[56] GEF-IWCAM website at http://www.iwcam.org/

[57] Global Forum website at http://www.globaloceans.org/freshwater/index.html

to stimulate information exchange, the World Ocean Observatory has launched a new freshwater to oceans website[58].

70. Within the framework of Northwest Pacific Action Plan (NOWPAP), a new activity on Integrated Coastal and River Basin Management (ICARM) was initiated in 2007 and is being implemented by a Pollution Monitoring Regional Activity Centre (POMRAC). A regional report on ICARM, based on national reports of the four NOWPAP member states, is planned to be finalized in 2009. Applying ICARM approach in the NOWPAP region will include the establishment and management of Marine Protected Areas (MPAs) which contributes to marine and coastal biodiversity conservation in the Northwest Pacific ocean.

Summary of implementation

71. As is evident from the above, the degree of implementation of IMCAM globally is relatively good. However, there are still much that could be done to expand the scope of IMCAM and to make it more effective. For example, PEMSEA notes that there is appreciation among the East Asian Seas countries of the need for comprehensive and responsive national coastal and marine policies to govern the management of resources and sectoral activities, in order to avoid conflicting uses of marine and coastal resources. More advanced countries have taken steps to develop and implement cross-sectoral national coastal and ocean policies. However, a significant number of other countries have not started the process due to lack of awareness among policymakers and/or limited capacity to address the issue. Laws and policy issuances remain largely sectoral and fall short of addressing cross-sectoral and multiple-use conflicts. The sectoral orientation relates to the institutional landscape that likewise fails to recognize the interconnectedness of environmental, social and economic concerns[59]. It should be noted that this problem likely extends well beyond the East Asian Seas area, and is common to many countries around the world.

72. The prevalence of sectoral laws is also noted by Estonia in its 4th National Report. Although marine and coastal environment is sufficiently protected by sectoral measures in Estonia, there has been hardly any success in applying an integrated approach in marine and coastal area management. Institutional, administrative or legislative arrangements are, as a rule, lacking a sufficient integrated dimension or clearly defined ecosystem approach. However, certain components of IMCAM can be implemented through existing laws, such as the Nature Conservation Act and the Water Act. Again, it is unlikely that Estonia is the only country experiencing the lack of enabling integrated policies and legislation.

73. Finally, a relatively large number of IMCAM guidance documents exist. Recent publications include the World Bank *Guidelines for Integrated Coastal Zone Management*, *The Dynamics of Integrated Coastal Management – Practical Applications in Sustainable Coastal Development in East Asia* (by Chua Thia-Eng, and available through the PEMSEA website), and IUCN's *Sustainable Livelihoods Enhancement and Diversification (SLED): A Manual for Practitioners*. The UN Division on Oceans and Law of the Sea (DOALOS) has developed a training course on the Development and Implementation of an Ecosystem Approach to the Management of Ocean-related Activities[60].

58 http://www.thew2o.net/node/18675

59 PEMSEA website at http://pemsea.org/programmes-and-projects/policies-and-reforms

60 DOALOS voluntary report on the implementation of the CBD programme of work on marine and coastal biodiversity.

Operational objective 1.2: To undertake direct action to protect the marine environment from negative impacts.

Implementation through the GPA

74. This activity is to a great extent implemented through the UNEP Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA). On the national level, GPA is implemented through National Programmes of Action for the Protection of the Marine Environment from Land-Based Activities (NPAs). The implementation of the GPA and the NPAs is primarily the task of national governments. NPAs are flexible and result-oriented programmes for the protection of the marine environment from land-based activities.

75. According the second Intergovernmental Review of the GPA in 2006, more than 60 countries are involved in NPA-related processes, most of which are part of regional efforts coordinated by relevant Regional Seas programmes. The status of these NPAs ranges from the planning or preparation phase to actual implementation through pilot projects. The activities included pollution control, including sewage, nutrients, POPs and heavy metals; waste water treatment; addressing eutrophication; environmental assessment and monitoring; as well as environmental restoration[61].

76. Since the adoption of the GPA, the legal and institutional arrangements that support action have been expanded and strengthened and now cover most regions of the world. The implementation of plans and programmes is underway and is increasingly seen as a contribution to the achievement of the targets set by the international community, such as The Millennium Development Goals and the Johannesburg Plan of Implementation[62].

77. One of the activities highlighted by the GPA is a project entitled *Addressing land-based activities in the Western Indian Ocean* (referred to as "WIO-LaB" in short). The project addresses some of the major environmental problems and issues related to the degradation of the marine and coastal environment resulting from land-based activities in the Western Indian Ocean (WIO) region. The project aims to improve the knowledge base, and establish regional guidelines for the reduction of stress to the marine and coastal ecosystem by improving water and sediment quality; strengthen the regional legal basis for preventing land-based sources of pollution; and develop regional capacity and strengthen institutions for sustainable, less polluting development[63].

Other regional and national activities to protect the marine environment from direct impacts

78. Action to reduce pollution and other direct impacts to the marine environment is also being taken outside of the GPA framework. For example, the Baltic Environment Protection Commission (HELCOM) adopted in 2007 the HELCOM Baltic Sea Action Plan, which is an ambitious programme to restore the good ecological status of the Baltic marine environment by 2021. The Action Plan addresses all the major environmental problems affecting the Baltic marine environment. It is based on a clear set of 'ecological objectives' defined to reflect a jointly agreed vision of 'a healthy marine environment, with diverse biological components functioning in balance, resulting in a good ecological status and supporting a wide range of sustainable human activities'. Example objectives include clear water, an end to excessive algal blooms, and viable populations of species. Targets for 'good ecological status' are based on the best available scientific knowledge[64].

---

61 http://www.gpa.unep.org/documents/igr-2_information_document_2_english.pdf

62 UNEP/GPA (2006). The State of the Marine Environment: Trends and processes. UNEP/GPA, The Hague. http://www.gpa.unep.org/documents/soe_-_trends_and_english.pdf

63 The Wio-Lab project website at http://www.wiolab.org/

64 The HELCOM website at http://www.helcom.fi/BSAP/en_GB/intro/

79. While the action plan is implemented jointly by all the Baltic countries, each of them also has their own regulations and activities related to reducing pollution and other direct impacts on the marine environment. For example, Finland reports that actions taken to reduce the pollution load of the Baltic Sea include control of industrial and municipal point sources of pollution in the Gulf of Finland. Prosecution has been strengthened to address deliberate illegal discharges of bilge oil associated with the increase of shipping in the Baltic Sea. Domestic measures are needed to further reduce nutrient loading from Finnish agriculture. There is also a need to strengthen pollution prevention from ships (e.g. oil pollution, pollution from hazardous and noxious substances, waste dumping). The Finnish Government approved in 2006 a new set of national Water Protection Policy Guidelines, with an aim to achieve good water quality by 2015. Finland implements the "Polluter-Pays Principle". In cases when the polluter cannot be identified, the national Oil Pollution Fund can cover the costs for oil pollution response[65].

80. The Black Sea experiences problems with eutrophication due to seasonal heavy river flows that carry nitrogen and phosphorous compounds as well as other pollutants, stimulating vigorous growth of phytoplankton and zooplankton. To combat these and other environmental challenges, the Black Sea countries adopted in April 2009 the Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea. This updated version of the 1996 and 2002 Action Plans describes the policy actions required to meet the major environmental challenges now facing the Sea, and includes a series of management targets[66].

81. Another example on reducing pollution and other impacts on the marine environment is the “sato-umi” approach employed in Japan. While Japan is actively monitoring pollution and implementing legislation, these actions are complemented by innovative approaches, highlighted in the box below, that rely on community-based action, and the resurrection of traditional knowledge systems.

Box 4. CASE STUDY: Creation of SATO-UMI (Japan)

The Japanese concept of “sato-umi” is centered around providing benefits to both people and biodiversity, putting into practice the CBD ecosystem approach that humans with their cultural diversity are an integral component of many ecosystems. In Japanese, “Sato” means the area where people live, while “Umi” means the sea. When "sato-umi" is restored in coastal waters, marine productivity and biodiversity are enhanced through the involvement of, and in harmony with, people.

The concept of sato-umi was originally introduced as an attempt to restore coastal seas that have been affected by marine pollution and associated impacts, such as eutrophication and red tides. The concept was subsequently incorporated into policy frameworks, including the “Strategy for an Environmental Nation in the 21st Century (2007)”, the “National Biodiversity Strategy and Action Plan (2007)” and the “Basic Plan on Ocean Policy (2008)”. The concept is being put into practice through a program of the Japanese Ministry of Environment, which supports the efforts of local governments, residents, non-profit organizations and universities to undertake diverse activities that include planting eelgrass to restore coastal ecosystems, public education, and working with fishing communities to revive traditional fishing methods.

As indicated above, the concept of sato-umi applies to coastal seas that have a close relationship with the public, and therefore includes even highly populated areas. For instance, in the Tokyo Bay area, large human populations cause a significant pollution load into the sea, while water purification is limited due to the lack of natural coast. Efforts have been undertaken by local residents and communities to improve water quality through various means, including through the use of oyster cultivation for water purification. By increasing the number of living and filter-

65 Finland’s voluntary report on the implementation of the programme of work on marine and coastal biodiversity

66 Bulgaria’s voluntary report on the implementation of the programme of work on marine and coastal biodiversity

feeding organisms ingesting nutrients from the land, the project aims to restore water quality in the Tokyo Bay.

The Government of Japan is currently undertaking activities to enhance the benefits of sato-umi, including distributing a sato-umi restoration manual and promoting related public awareness and education. Japan wishes to actively contribute to the conservation and restoration of marine and coastal environments all over the world through the sato-umi initiative, and is presently disseminating the outcomes derived from these efforts through the sato-umi website

Source: Japan's voluntary report on the implementation of the programme of work on marine and coastal biodiversity

Summary of progress

82. While progress relating to regulatory mechanisms within the GPA and other initiatives has been positive, progress in dealing with pollution has been variable depending on the source of pollution and specific geographical locations. There are three areas where good progress has been made (Persistent Organic Pollutants, Radioactive Substances, Oils (Hydrocarbons)), two areas where results are mixed (Heavy Metals and Sediment mobilization), and yet a third group where conditions have worsened (Sewage, Nutrients, Marine Litter, Physical Alteration and Destruction of Habitats). On the one hand success is directly related to factors such as the regulatory system, institutional structures, technology or funding, all areas of concern to the GPA. On the other hand there are factors that are outside the scope of the GPA but that nevertheless have a determining influence, as is the case of population growth and development. The conclusion is that, while progress has undoubtedly been made and continues to be feasible, there is still a long way to go. This conclusion is supported by the increases in nitrogen concentrations during recent years in many watersheds around the world and in the number of dead zones globally (see figure 1)[67].

Operational objective 1.3: To develop guidelines for ecosystem evaluation and assessment, paying attention to the need to identify and select indicators, including social and abiotic indicators that distinguish between natural and human-induced effects.

Available guidelines and indicators

83. Guidelines for ecosystem evaluation and assessment have been developed by a number of international projects, as well as nationally. Of the international projects, those most applicable to implementation of IMCAM include the assessment and monitoring processes employed by Large Marine Ecosystem projects and the IOC Handbook on Indicators for Coastal and Ocean Management. Regional assessment processes include the OSPAR Quality Status Reports, which provide a critical evaluation of the status of the NE Atlantic. Regional indicators include the PEMSEA integrated coastal management indicators, as well as indicators included in the annexes of the EC Habitats Directive and Birds Directive. Nationally, Canada has created an ecosystem Indicators Working Group.

84. The *Handbook for Measuring the Progress and Outcomes of Integrated Coastal and Ocean Management* is the culmination of four years of work, organized under the umbrella of the IOC Programme on ICAM, through a long-standing partnership with NOAA, DFO (Canada) and the Center for Marine Policy (University of Delaware, USA). The handbook aims to contribute to the sustainable

67 UNEP/GPA (2006). The State of the Marine Environment: Trends and processes. UNEP/GPA, The Hague. http://www.gpa.unep.org/documents/soe_-_trends_and_english.pdf

development of coastal and marine areas by promoting a more outcome-oriented, accountable and adaptive approach to integrated coastal and ocean management (ICOM). It provides a step-by-step guide to help users in developing, selecting and applying a common set of governance, ecological and socioeconomic indicators to measure, evaluate and report on the progress and outcomes of ICOM interventions. Intended as a generic tool with no prescriptive character, the handbook proposes analytical frameworks and indicators that form the basis for the customized design of sets of indicators. It is available on-line at http://unesdoc.unesco.org/images/0014/001473/147313e.pdf.

85. In the context of the LME projects, a key factor in reaching a determination on the status of ecosystem condition is the quantitative output from 5 modules of spatial and temporal indicators of ecosystem (i) productivity, (ii) fish and fisheries, (iii) pollution and ecosystem health, (iv) socioeconomics and (v) governance. Advances in technology now allow for cost-effective measuring of the changing states of LMEs using these suites of indicators. The five-module indicator approach to the integrated assessment and management of LMEs has proven useful in ecosystem based projects in the United States and elsewhere[68].

Conclusions

86. It is evident from the above that progress continues to be made in the implementation of IMCAM globally, with new tools and approaches becoming available, and an increasing number of countries and regions undertaking IMCAM initiatives. However, the integration of biological diversity concerns into sectoral activities still remains a challenge for IMCAM. Similarly, coordination between sectors and levels of government remains a challenge, as many activities, policies and legislation is of a sectoral nature and does not provide for integration.

87. It is also evident that increasing population growth and development continue to drive the loss of biodiversity in coastal areas, and that these pressures are difficult to control with existing instruments. It is also likely that in the future climate change will add further pressures to these already stressed environments.

Programme element 2: Marine and coastal living resources

Operational objective 2.1: To promote ecosystem approaches to the conservation and sustainable use of marine and coastal living resources, including the identification of key variables or interactions, for the purpose of assessing and monitoring, first, components of biological diversity; second, the sustainable use of such components; and, third, ecosystem effects.

Status and trends in implementation of the ecosystem approach in marine and coastal areas

88. The implementation of the ecosystem approach is still lacking in ocean areas in general, although work through the FAO on developing an Ecosystem Approach to Fisheries shows promise as a sectoral approach to responsible management. In coastal areas, the ecosystem approach has been more commonly implemented through IMCAM initiatives. Many countries are also undertaking related initiatives towards the conservation and sustainable use of marine living resources. For example, according to the 3rd National Reports, 93.1% of all coastal Parties that submitted the national report have taken action to control excessive and destructive fishing practices. 24.5% of those Parties had plans in place for a comprehensive assessment of marine and coastal ecosystems, while another 26.5% of Parties already had such assessments in progress. 90.20% of Parties had undertaken protection of areas important for reproduction, such as spawning and nursery areas.

68 LME Project website at http://www.lme.noaa.gov/

National and regional activities relating to the ecosystem approach

89. National initiatives include South Africa's National Spatial Biodiversity Assessment, which has a marine component; a project in Brazil together with the FAO titled "ecosystem approach to management of fisheries for the Lagos dos Paros and the adjacent coastal areas"; the development of a comprehensive information system for organizing and sharing information on the marine and coastal environment in Argentina (El SICOM - Sistema Informático Costero Marino); legislated species protection, species recovery, habitat protection and threat abatement activities as well as application of the ecosystem approach to fisheries in Australia; sustainable management of fish and crustaceans in Sweden; and a project titled "Latitudinal differences on the biology of key species in estuarine systems as indicators for changes caused by climatic changes" in Portugal.

90. Regionally, many countries have collaborated to make progress towards the implementation of the ecosystem approach in the context of Regional Fisheries Management Organizations (RFMOs) in accordance with UN General Assembly resolution 61/105. While many RFMOs and arrangements, such as CCAMLR in the Southern Ocean, are very advanced in their implementation of the ecosystem approach, in some others implementation has been minimal to date. The ecosystem approach is also put in practice in the context of Large Marine Ecosystem projects and programmes, as shown by the example from the Benguela Current LME in the box below.

Box 5. CASE STUDY: The Benguela Current Large Marine Ecosystem Programme

The Benguela Current Large Marine Ecosystem - one of the worlds four major upwelling marine ecosystems - is one of the world's most productive ecosystem, providing energy materials, food security and foreign exchange earnings. The region's natural beauty and abundant wildlife provides substantial revenue from tourist activities while near shore and offshore sediments contain rich mineral deposits as well as oil and gas reserves. Unsustainable pilchard and anchovy fishing led to the collapse of the South African and Namibian fishing industry in the 1960s and 1970s. Overfishing of hake, usually by foreign fleets, saw this resource severely depleted by 1973 and led to the declaration of 200-mile exclusion zones in 1977 (South Africa) and 1990 (Namibia).

The BCLME Programme was designed to improve the structures and capacities of Namibia, Angola and South Africa to deal with their transboundary environmental problems and manage the BCLME in an integrated and sustainable manner.

Transboundary issues include the migration of fish stocks across national boundaries, the introduction of invasive alien species, and the movement of pollutants or harmful algae from the waters of one country into another.

The programme assists governments to manage their shared marine resources - fish, diamond mining and petroleum exploration - in an integrated and sustainable way. Key areas also include environmental variability, coastal zone management, ecosystem health, socio-economics and governance. More than 75 different projects and activities are now being carried out by activity centres in the three countries in close cooperation with the commercial fishing, and oil and gas industries, as well as with the offshore diamond mining industries of Namibia and South Africa.

Source: UNDP voluntary report on the implementation of the prorgamme of work on marine and coastal biodiversity

91. Activities are also being undertaken in the framework of Regional Seas Programmes. For example, the Regional Organization for Conservation of Environment of the Red Sea and Gulf of Aden (PERSGA) has developed a Strategic Action Plan on Effects of Climate Change on Marine Resources. Another PERSGA activity addresses the undervaluation of marine ecosystems and resources through work aimed at developing an economic valuation tool to examine how the costs and benefits of ecosystems are regionally distributed. Resource valuation is a crucial step for developing the socioeconomic mapping upon which PERSGA develops sustainable income-generating socioeconomic projects in the Red Sea and Gulf of Aden region. PERSGA's 2005 workshop "Towards ICZM: Balancing Standards of Life for Coastal Communities" emphasised the need to assess the economic value of the coastal and marine life in the Region's coastal zones and the development of indicators and assessment tools accordingly. PERSGA is working towards establishment of partnerships with the World Bank, other Regional Seas Programmes and the Large Marine Ecosystems (LME) Initiative for the adoption of an economic valuation scheme and its related activities[69].

92. Kiribati has proposed a Pacific Oceanscape Initiative at the August 2009 40th Pacific Islands Forum. A Pacific Oceanscape could extend from Micronesia, Melanesia and throughout Polynesia, potentially traversing tropical and temperate systems from Hawaii to New Zealand. The Oceanscape could be defined as a large, multiple use area, in which governments, regional agencies, donors, civil society, and other stakeholders cooperate to conserve the diversity and abundance of life in the ocean and on land, and in doing so secure ecosystem services that provide for human well-being. The initiative would encompass Pacific Ocean Arcs, and would include protected areas as well as integrated management, and addressing the needs of migratory species. Kiribati will work with all interested parties to develop the concept further in 2010.

Tools and partnerships

93. Additional work on economic valuation is being undertaken by the World Bank in collaboration with UNEP-World Monitoring Conservation Center (UNEP-WCMC) and the World Resources Institute. The organizations have embarked on developing a toolkit of methods and approaches for valuing marine ecosystem services across a range of habitat types and development contexts. The report titled "Valuation of Marine Ecosystem Services: A Gap Analysis" provides information on the preparation of the toolkit.

94. Many of the World Bank's activities with respect to fisheries are undertaken through the PROFISH partnership. PROFISH facilitates close cooperation with other leading international entities such as FAO, WorldFish Center and the GEF. PROFISH brings donors and stakeholders together in support of a common vision for sustainable fisheries development planning and management at the national, regional and global levels. The sustainable fisheries work falls into three main categories: development of global goods; activities at the regional level (such as studies and cooperation among countries) and activities at country level (such as World Bank loans or grants, and studies or technical advice)[70].

95. Lack of effective engagement from all ocean stakeholders, in particular industry, has long been an impediment to implementing the ecosystem approach. One new initiative aiming to engage the private sector is the World Ocean Council (WOC), which is working on catalyzing a global cross-sectoral industry leadership alliance to build capacity within the private sector to constructively engage on environmental policy and strategy developments. The WOC is working to raise the awareness of the private sector regarding the need and value of ecosystem based management and marine spatial planning for the marine environment, especially at an international scale[71].

---

[69] PERSGA voluntary report on the implementation of the programme of work on marine and coastal biodiversity and the PERSGA website at www.persga.org

[70] World Bank contribution to the Report of the Secretary-General on Oceans and Law of the Sea

[71] WOC voluntary report on the implementation of the prorgamme of work on marine and coastal biodiversity

Operational objective 2.2: To make available to the Parties information on marine genetic resources in marine areas beyond national jurisdiction and, as appropriate, on coastal and marine genetic resources under national jurisdiction from publicly available information sources.

Marine genetic resources and their uses

96. The world's oceans host 32 of the 34 known phyla on Earth, and contain somewhere between 500,000 and 10 million marine species. Species diversity is known to be as high as 1,000 per square meter in the Indo-Pacific Ocean, and new oceanic species are continuously being discovered, particularly in the deep sea. It is therefore not surprising that the genetic resources in the world's oceans and coasts are of actual and potential interest for commercial uses. There are numerous patents filed on marine genetic resources, which have led to products already on the market[72]. Many of these products are of benefit to humankind.

97. Some examples of products developed from marine genetic resources can be found in the box below.

Box 6. Some examples of products derived from marine genetic resources

- **The pain medication Prialt**, based on a synthetic derivative from marine cone shell venom from Indonesia, is now on the market and is manufactured by the Elan Corporation.
- **Fuelzyme™ enzyme** was developed on the basis of samples collected from a deep-sea hydrothermal vent, likely from the Mid-Atlantic Ridge. This enzyme, which is currently marketed by Verenium (USA), is used in ethanol production from corn.
- **Vent polymerase** is a thermostable enzyme sourced form a hydrothermal vent archaebacteria in Italy. It is marketed by New England Biolabs (USA) for use in DNA cloning, sequencing and amplification.
- **Deep Vent®** is an enzyme sourced from the bacteria *Pyrococcus* sp. from Guaymas Basin hydrothermal vents, Gulf of California, from a depth of 2100m. It is marketed by New England Biolabs (USA) for use in molecular biology and biotechnology.
- **Yondelis®**, an anti-cancer agent originally sourced from a Caribbean sea slug, has received Authorization for Commercialization from the European Commission for advanced soft tissue sarcoma. It is marketed by the Spanish company PharmaMar.
- **Anti-freeze proteins** from cold ocean fish are being marketed for uses ranging from improving the survival of biological materials, for example in transplant surgery to lengthening the shelf life of frozen foods, such as ice cream.
- The Southern Ocean marine algae *Durvillea antarctica* is one of the ingredients in **Extra Firming Day Cream** produced by the French Company Clarins.

Source: UNU-IAS report titled "A summary of the status of marine biological prospecting with particular emphasis on deep and open ocean areas".

98. The topic of marine genetic resources beyond the limits of national jurisdiction has been discussed by the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and

72 D. Leary, M. Vierros, G. Hamon, S. Arico and C. Monagle. 2009. Marine Genetic Resources: A review of scientific and commercial interest. Marine Policy 33: 183– 194

sustainable use of marine biological diversity beyond areas of national jurisdiction, most recently in January 2010. While policy issues related to this topic are outside the mandate of the CBD, some limited information on commercial uses of these genetic resources exists. As indicated in the paragraphs above, many patents or products are based on marine genetic resources collected from open ocean and deep sea environments, particularly from hydrothermal vents. However, it is often difficult to tell whether the collection sites were located in marine areas beyond the limits of national jurisdiction. The coordinates of the collection site are often not included in patent applications, and the source organism may have been obtained from a culture collection or other ex-situ collection. To date, only a couple of patent applications can be said with any certainty to have been based on organisms that originated from the deep seabed beyond national jurisdiction. A greater number relate to organisms sourced from the water column beyond national jurisdiction. In view of likely continued commercial interest on marine genetic resources from the deep sea, it will be important to improve the available information relating to location of collection and types of uses[73].

99. Given the critical role of genetic resources for food security, the FAO Conference established the intergovernmental Commission on Genetic Resources for Food and Agriculture. With more than 170 Member Countries, it is the largest intergovernmental body of FAO after the Conference. The Commission mandate covers "all biological diversity of relevance for food and agriculture", including those aquatic genetic resources, in both inland and marine waters, which are important for fisheries and aquaculture.

100. In response to an information request by this Commission, the FAO convened in 2006 a workshop of internationally recognized experts to review the status and trends of genetic resources for aquaculture and fisheries. A summary of the workshop findings can be found at http://www.fao.org/ag/cgrfa/cgrfa11.htm (see Background Study Paper 36). The proceedings of the workshop have also been published by FAO[74]. Taking into account the relevant inputs provided by experts, FAO prepared a review of the status and needs on aquatic genetic resources for food and agriculture, so that the Commission could make informed decision-making in establishing its future agenda of work. The review focused on genetic resources of direct importance for aquaculture, and for capture fisheries taking place in inland, coastal and oceanic waters.

101. The review emphasized that a transition to more responsible, sustainable and productive aquaculture and capture fisheries will depend in large measure upon effective management of fish genetic resources. Fish genetic resources management merits high emphasis in ecosystem approach to fisheries. In capture fisheries, improved information on fish genetic resources can help determine the productivity of fished populations and their adaptability to environmental change, including climate change. Improved genetic characterization of fish stocks could improve the traceability of fish products and contribute to better compliance. Finally it stressed that the management of fish genetic resources for aquaculture and capture fisheries is being constrained by the lack of effective policies.

102. The FAO's future work on this topic will include a review of the information base for aquatic genetic resources, including a scoping policy analysis to identify gaps and opportunities; production of a major review on the *State of the World's Aquatic Genetic Resources*; and development of elements related to the FAO's Code of Conduct of Responsible Fisheries, aimed to maintain a broad genetic basis and to ensure sustainable use and conservation of Aquatic Genetic Resources, including development of technical guidelines.

---

73 Information presented at United Nations University Institute of Advanced Studies (UNU-IAS) Side event on Marine Genetic Resources in the Deep and Open Ocean at the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction (New York, 1 February, 2010).

74 FAO (2007) The World's Aquatic Genetic Resources: Status and Needs. Background document CGRFA-11/07/15.2 for the Eleventh Regular Session of the Commission on Genetic Resources for Food and Agriculture. ftp://ftp.fao.org/ag/cgrfa/cgrfa11/r11w152e.pdf

National implementation

103. Some countries have addressed the issue of marine genetic resources nationally. For example, Canadian scientists have pre-existing mechanisms in place to share information gathered on genetic resources. Publicly available free sites include the United States National Institutes of Health sites GenBank (http://www.ncbi.nlm.nih.gov/Genbank/index.html) and Pubmed (http://www.ncbi.nlm.nih.gov/pubmed/). These sites provide public access to genetic sequencing data for most known and available genes, including fish and marine derived proteins and nucleotides.

104. Australia has several monitoring studies underway to trial new and emerging technologies for this area, including: biological surveys, genetic analysis and classification of remote deepwater habitats; remote sensing for habitat typing and benthic mapping; and data logging technology to monitor water temperature and indicate climate change effects in reserves. The results of these studies are typically made publicly available on the internet for access by other organisations.

105. Under Australian Government regulations, researchers investigating genetic resources in Commonwealth marine areas are required to submit lists of samples collected. It is planned that this and other relevant biological information will be made available through the web-based 'Atlas of Living Australia', which is currently under development.

Information sources

106. In order to improve the informational basis for policy discussions in regards to genetic resources, the United Nations University Institute of Advanced Studies (UNU-IAS) has undertaken extensive work to assess the status of marine biological prospecting globally. A key component of this process has been the development, in collaboration with UNESCO, of a Marine Biological Prospecting Information Resource. This Information Resource includes a searchable database which provides details of research and commercialized products arising from biological samples that were sourced from the world's oceans and coastal areas. Also included are tools and resources related to legislation, customary law, declarations, access and benefit-sharing, intellectual property, economics and valuation. Related Information Resource Tools on Antarctica, the Pacific Islands and the Arctic also contain marine components. All Bioprospecting Resource Tools can be accessed through http://www.bioprospector.org/bioprospector/.

107. Information regarding marine genetic resources is also available from the CBD Secretariat at https://www.cbd.int/marine/seabed.shtml.

Operational objective 2.3: To gather and assimilate information on, build capacity to mitigate the effects of, and to promote policy development, implementation strategies and actions to address: (i) the biological and socio-economic consequences of physical degradation and destruction of key marine and coastal habitats including mangrove ecosystems, tropical and cold-water coral-reef ecosystems, seamount ecosystems and seagrass ecosystems including identification and promotion of management practices, methodologies and policies to reduce and mitigate impacts upon marine and coastal biological diversity and to restore mangrove forests and rehabilitate damaged coral reef; and in particular (ii) the impacts of mangrove forest destruction, coral bleaching and related mortality on coral-reef ecosystems and the human communities which depend upon coral-reef services, including through financial and technical assistance

Global information on ecosystems and species

108. Information at the global scale on a large variety of marine ecosystems and species is being compiled by the Census of Marine Life (the Census), a global network of researchers now finalizing their work. The box below describes the Census in more detail.

Box 7. CASE STUDY: The Census of Marine Life

The Census of Marine Life is a global network of researchers in more than 80 nations engaged in a 10-year scientific initiative to assess and explain the diversity, distribution, and abundance of life in the oceans. The world's first comprehensive Census, which began in 2000, is coming close to completion and will be released in 2010. Some of the preliminary results of the Census have contributed to the present review (see section 2: Global Status and Trends of Marine Biodiversity).

In keeping with its purpose to assess and explain diversity, the Census aims to make for the first time a comprehensive global list of all forms of life in the sea. No such unified list yet exists. The database of the Census already includes records for more than 16 million species, old and newly discovered (see http://www.iobis.org/), and the extent of data available is illustrated in the map below (red areas represent available data). By 2010, the goal is to have all the old and new species in an on-line encyclopedia with a webpage for every species. In addition, the Census will estimate how many species remain to be discovered. The number could be astonishingly large, perhaps a million or more, if all small animals and protists are included.

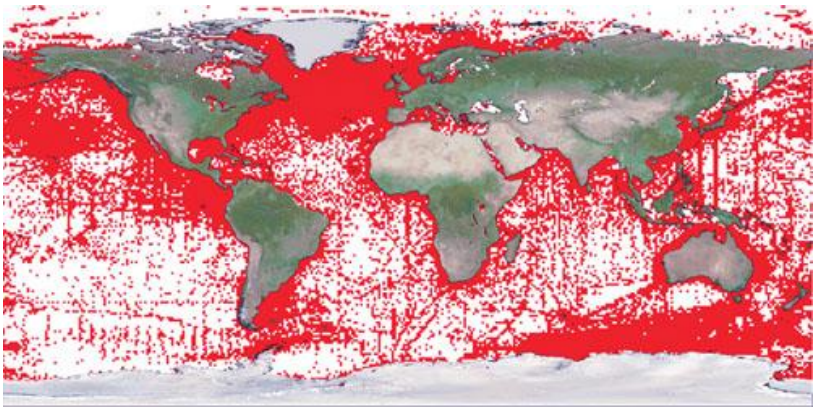


Figure: The extent of data available (red areas) in the Ocean Biogeographic Information System (OBIS).

The Census also aims to assess and explain the distribution and abundance of species in the sea.

The Census will produce maps of where the animals have been observed or where they could live, that is, the territory or range of the species, and estimate population sizes either in numbers or biomass. These factors are important for understanding the ecology of the ocean and for forecasting the future. Knowing the range of species may assist, for example, in predicting the possible consequences of global climate change.

The Census works through 14 field projects to conduct research concerning all major habitats and groups of species in the global ocean. Eleven field projects address habitats, such as seamounts or the Arctic Ocean. Three field projects look globally at animals that either traverse the seas or appear globally distributed: from top predators such as tuna down to plankton and microbes. Examples of specific projects include Global Census of Marine Life on Seamounts (CenSeam), Census of Coral Reefs (CReefs) and Biogeography of Deep-Water Chemosynthetic Ecosystems (ChEss). The Census also includes projects related to constructing the history of marine animal populations and to forecasting the future through numerical modeling and simulation.

The Census will help meet the information needs of the Parties to the CBD through providing baseline information locally, regionally and globally. The Census of Marine Life's global network of researchers will also provide critical information to help guide decisions on how to manage global marine resources for the future.

109. A number of other complementary global databases and information systems also exist, and these are often linked to each other. Examples include, but are not limited to, FishBase[75] (an information resource on all fish), CephBase[76] (a database of cephalopods, such as octopus and squid) and ReefBase[77] (a coral reef information resource). The box below describes The Global Procellariiform Tracking Database, containing information about albatrosses and petrels.

Box 8. CASE STUDY: The Global Procellariiform Tracking Database

A further example of a coordinated and collaborative database is the Global Procellariiform Tracking Database, formed in 2003 through a unique collaboration between scientists worldwide, analysing the distribution of albatrosses and petrels across the world's oceans[78]. Data holders have established a protocol for access to and sharing of the database, which, as of 2008, held data on 28 species contributed by 57 scientists from 11 countries. The database thus represents a vital tool for the conservation of these species.

[75] www.fishbase.org

[76] http://www.cephbase.utmb.edu/

[77] www.reefbase.org

[78] BirdLife International (2004) *Tracking Ocean Wanderers: the global distribution of albatrosses and petrels*. Cambridge, UK: Birdlife International (results from the Global Procellariiform Tracking Workshop, 1–5 September 2003, Gordon's Bay, South Africa).

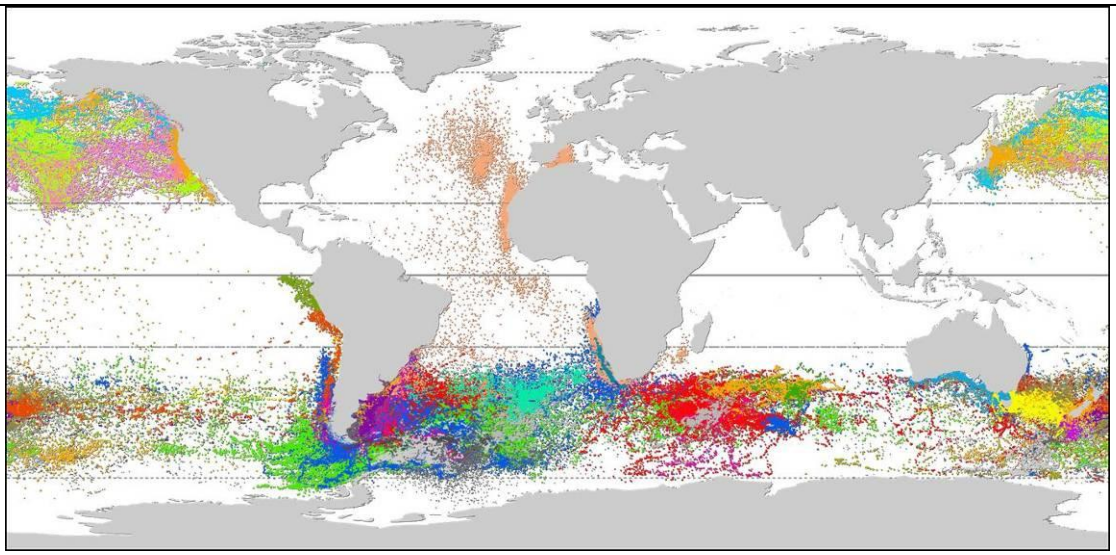


Figure: Summary of data held within the Global Procellariiform Tracking Database, which includes 3,764 tracks totalling 957,148 hours from Platform Transmitter Terminal (PTT) and Global Positioning Satellites (GPS), and 721 tracks totalling 61,832 days from Geolocators (GLS).

A key use of the database has been in work with Regional Fisheries Management Organisations (RFMOs), particularly the world's five tuna commissions, to identify the spatial and temporal overlap between bird distribution and longline fishing effort. These analyses have proven vitally effective tools in reducing seabird bycatch.

Mangrove ecosystems

110. A number of countries are reporting new activities related to the conservation of mangroves, including re-planting projects throughout South East Asia. One such project, taking place in India, is described in the box below. Brazil is undertaking a project titled Effective Conservation of Mangrove Ecosystems in Brazil, which aims to promote the conservation and sustainable use of mangroves, their environmental services and functions. Global assessments of mangrove resources are undertaken by the FAO and by UNEP-WCMC, with a new Mangrove Atlas expected in 2009 or 2010.

Box 9. CASE STUDY: Protection of mangroves in the Pichavaram region, India

Mangrove wetlands provide a variety of protective and productive services to the coastal communities: they mitigate the adverse impact of storms, cyclones and tsunamis in coastal areas; reduce coastal erosion and increase land cover by accretion; act as breeding, nursery and feeding grounds for many commercially important prawns, fish, crabs and molluscs; and enhance the fishery potential of adjacent coastal waters by providing them with large quantities of organic and inorganic nutrients.

The 2004 tsunami has not only caused destruction to human life and property but also serious damage to the coastal ecological and economic resources. On the other hand, the coastal vegetations have played a role to some extent in mitigating the impact of the Tsunami on these coastal communities.

In 1996 M. S. Swaminathan Research Foundation (MSSRF), Chennai, launched a major

programme on the restoration of the mangrove wetlands of the east coast of India.

The programme aims at:
a) conserving and regenerating mangroves along the east coast of India: establishment of bio-shields along the coast involving raising plantations of mangrove trees in suitable areas; intensive nursery management system for mangrove plants with coastal communities; development of a manual on how to propagate mangrove plants;
b) strengthening the participation of stakeholders in the conservation and management of mangrove forests through education, training and policy support: creation of a "Coastal Bio-village" tool-kit focused on the sustainable use of natural resources, introduction of market-driven, livelihood options not dependent on farming, as well as value addition to primary products; and
c) identifying and transferring salt tolerance genes from mangroves species to crops like rice and mustard growing in coastal areas.

The Community-based group is the active implementing agency at the village level. An agreement was signed between MSSRF and the local community-based group, indicating clear roles and responsibilities for each of the partners, monitoring mechanism and sharing of the resources and benefits.

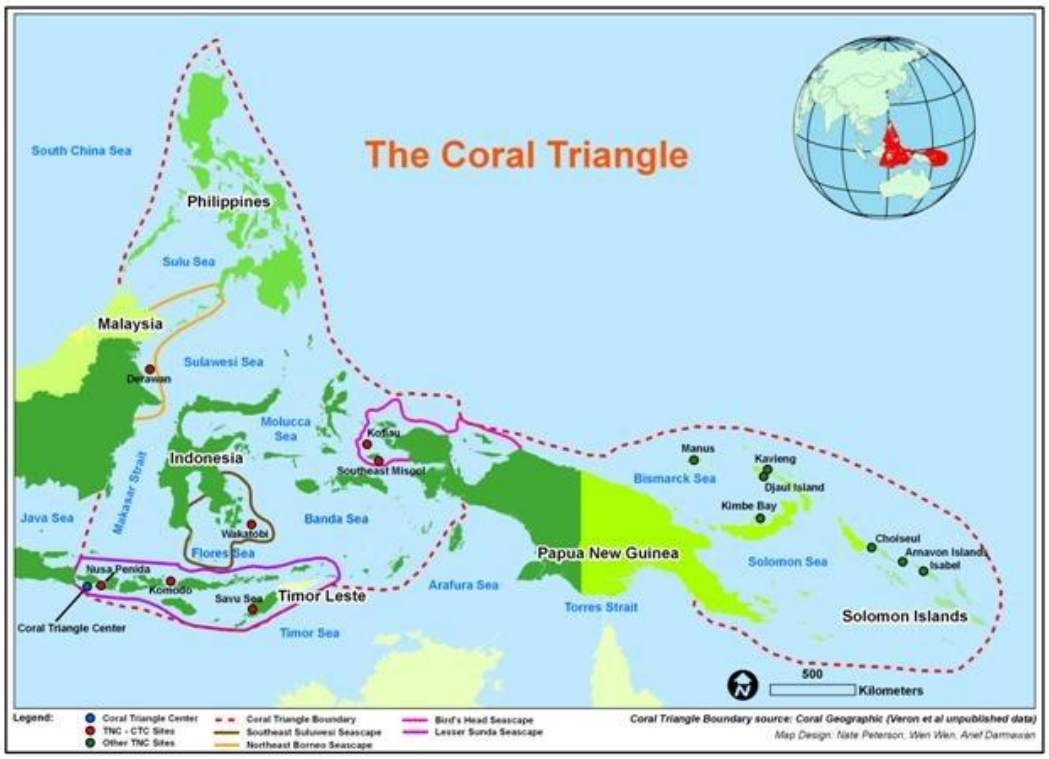
Tropical coral reefs

111. Major new initiatives towards the conservation and sustainable use of coral reefs have been initiated during the last few years. These include the Coral Triangle Initiative (see box below), the GEF-World Bank Coral Reef Targeted Research Project, The Coral Reef Initiatives in the Pacific (CRISP) Programme, the Micronesia Challenge, the Caribbean Challenge and the Indian Ocean Challenge. In addition, a number of marine protected areas encompassing large coral reef components have been established, and are discussed in more detail in the chapter relating to programme element 3 (marine and coastal protected areas).

Box 10. CASE STUDY: The Coral Triangle Initiative

Conservation of the world's highest biodiversity coral reefs, strengthening regional food security and promoting economic growth are the targets for Indonesia, Philippines, Malaysia, Papua New Guinea, the Solomon Islands and Timor Leste. The countries in question formed the Coral Triangle Initiative in 2007 in response to calls by the CBD, the WWF, Conservation International and The Nature Conservancy to reduce the loss of biodiversity and set up networks of MPAs. The initiative provides an example of large-scale efforts for building coral reef resilience, as called for under operational objective 2.2. (coral bleaching and physical degradation and destruction work plans). President Yudhoyono of Indonesia is marshalling international assistance to conserve biodiversity, fisheries and food security potential of these vast marine resources surrounding thousands of islands with a current budget of $300 million from governments, UN agencies and NGOs.

At the launch of the Coral Triangle Initiative in 2009 at the World Ocean Conference, Manado, Indonesia, the Coral Triangle Initiative Roadmap and Regional Plan of Action (RPoA) were endorsed by country leaders. The regional objectives, as set out by the RPoA, include a network of marine protected areas, alternative livelihoods programmes, pilot projects in each country and the establishment of a rapid alert system for marine biodiversity in the Coral Triangle. To complement the RPoA, National Plans of Action (NPoA) are currently being developed to articulate country based needs and challenges.



Sources: The Coral Triangle Initiative Secretariat website (http://www.cti-secretariat.net/) and Status of Coral Reefs of the World: 2008

112. A great deal of action continues to be mobilized through the International Coral Reef Initiative (ICRI). ICRI is a partnership among governments, international organizations, and non-government organizations. It strives to preserve coral reefs and related ecosystems by implementing Chapter 17 of Agenda 21, and other relevant international conventions and agreements. The current secretariat for ICRI is co-hosted by France and Samoa, while Mexico and the United States co-hosted from 2007 to 2009**,** and Japan and Palau from 2005 to 2007. At that time, Japan and Palau developed the Regional Marine Protected Area database titled "Coral Reef MPAs of East Asia and Micronesia". Japan also hosted the International Coral Reef Marine Protected Area Network Meeting. ICRI is supported by its operational network, the International Coral Reef Action Network (ICRAN).

113. The GEF-World Bank Coral Reef Targeted Research and Capacity Building for Management (CRTR) Programme is a global partnership supported by the GEF, the World Bank Development Grant Facility (DGF), the University of Queensland, and NOAA USA. The aim of the programme is to address key knowledge gaps in our understanding of how coral reef ecosystems respond to climate change and provide this information for decision-makers to promote needed actions for sustainable reef conservation. CRTR is a three-phase initiative that: 1) lays the scientific foundation for improved management interventions; 2) builds capacity to carry out adaptive research and management in key coral reef regions; and 3) works to integrate findings into management and policy at local, regional and international levels. The CRTR programme is nearing the end of its first 5-year phase, and has, to date, developed a robust research programme involving international teams of scientists being implemented at four Centers of Excellence in Mexico, Philippines, Tanzania and Australia. Results also include scientific publications and new tools to assess threats to coral reefs and design remedial action, including remote sensing tools to predict coral bleaching.

114. The Coral Reef Initiatives in the Pacific (CRISP) Programme is implemented by 18 technical agencies with projects in 17 countries (including 3 French Overseas Territories) to improve the capacity to manage coral reefs sustainably for the benefit of Pacific people. The initial basis was French seed funding of 6 million euros, complemented by funding form other partners. The project has achieved substantial progress since 2005 on improving scientific knowledge and applied management of coral reefs; developing sustainable alternative income generating activities; expanding coral reef monitoring; disseminating lessons learned; training and awareness raising; and developing and strengthening networks.

115. UNEP-WCMC is working in partnership with NOAA to develop the Global Coral Disease Database (GCDD), the only global repository of coral disease information. The database was established in 2000 to compile and organize published data on the occurrence of coral disease for the benefit of managers, scientists and policy makers. In 2008-9 a new phase of work will be developing the functionality of the database online to increase the accessibility of this information to decision makers responsible for managing coasts and oceans.

116. Our knowledge about the status of and trends in coral reefs globally and regionally is greatly enhanced by the bi-annual Status of the Coral Reefs of the World reports produced by the Global Coral Reef Monitoring Network (GCRMN). GCRMN was formed in 1996 as an operational network of the International Coral Reef Initiative (ICRI). Each report aims to present the current status of the world's coral reefs, the threat to the reefs, and initiatives that have been undertaken under the umbrella of ICRI to arrest the decline in the world's coral reefs. The reports are produced using the data and information from many coral reef experts around the world. For example, 372 experts from 96 countries contributed to the 2008 status report. The status reports also generally include a list of recommendations for action to conserve coral reefs. The recommendations of the 2008 report are presented in the box below. While some of these actions are outside the scope of the CBD, other fall within it, and may provide useful guidance for future updates to the programme of work on marine and coastal biological diversity as it pertains to coral reefs.

Box 11. RECOMMENDATIONS FOR ACTION TO CONSERVE CORAL REEFS
Reproduced from the Status of Coral Reefs of the World: 2008

- **Urgently combat climate change** – current rates of climate change pose the greatest threat to the long-term sustainability of coral reefs and human coastal communities. We request that the world community, through their governments, agencies, NGOs, academic institutions and especially business establishments, collaborate to urgently reduce the current rate of emissions of greenhouse gases through reductions in energy use and the development of sustainable energy generating mechanisms or trading systems, and develop technologies to remove these gases, especially CO_2, from the atmosphere, to ensure that coral reefs will thrive in the next century.
- **Maximise coral reef resilience** (by minimizing direct human pressures on reefs) – the second major threat to reefs derives from direct human activities: over-fishing and destructive fishing; sediment pollution from poor land use; runoff of nutrients and other pollution; and habitat loss through unsustainable development. Control of these threats, which are damaging reefs around the world especially in developing countries including small island developing States, will improve resilience of coral reefs in the face of climate change. These countries need assistance to improve local catchment and coastal management by upgrading capacity and providing funds to implement community-based management and develop alternative livelihoods to take pressures off reefs.
- **Scale up management of protected areas** – there is a need to improve management of existing marine protected area (MPAs) to accelerate restoration of depleted fish stocks and protect coral reef goods and services that underpin coastal economies and livelihoods. This

includes managing adjacent catchment areas to prevent nutrient and sediment pollution to create buffer areas that will reinforce MPA management activities. Learning to manage MPAs at the site level will assist countries to scale up costal management towards the integrated management of the entire coastal zone.

- **Include more reefs in MPAs –** a proven and effective governance approach for conserving coral reefs and promoting sustainable use is to include them in effectively managed MPAs; preferably containing a significant proportion as fishery reserves or no-take areas, linked into a network of MPAs, and embedded within a larger governance framework. Developing countries will need assistance in expanding their MPA networks and establishing integrated coastal management (ICM) governance frameworks.
- **Protect remote reefs –** there are many coral reefs remote from continental land masses and human populations that, if they are protected, will be able to act as reservoirs of biodiversity to replenish depleted reefs. We recommend establishing more MPAs to include many of the remote island reefs, like those to the west of Hawaii, in Kiribati, and the Coral Sea east of the Great Barrier Reef. Developed countries may have the best resources in governance and enforcement to conserve large remote areas in their territorial waters.
- **Improve enforcement of MPA regulations –** enforceable governance systems will be required to deal with the formidable problem of regulating access to managed ecosystems (including types and rates of resource exploitation). Many countries will need assistance to establish effective enforcement systems that function in different coastal and marine environments and do not undermine local cultural values and practices.
- **Help improve decision making with better ecological and socioeconomic monitoring –** there is an urgent need to upscale monitoring, especially with increasing threats of climate change, to ensure that this information is provided to natural resource managers and decision makers so that appropriate actions can be taken to reduce threat to reefs and coastal communities.

Source: Status of Coral Reefs of the World: 2008

117. The efficacy of marine protected areas (MPAs) in increasing coral reef resilience has recently been tested. The research in question was undertaken through a compilation of a global database of 8534 live coral cover surveys from 1969–2006 to compare annual changes in coral cover inside 310 MPAs to unprotected areas. The research findings indicate that, on average, coral cover within MPAs remained constant, while coral cover on unprotected reefs declined. These trends were particularly noticeable in the long term. The research findings give further weight to the recommendations relating to coral reef protection through MPAs included in the box above, and the need to put emphasis on implementing new MPAs and strengthening management and enforcement in existing MPAs[79].

Other ecosystems

118. The decline and loss of shellfish reefs globally is discussed in detail in the status and trends section of this report. The Nature Conservancy is currently preparing an analysis called "Shellfish Reefs at Risk: A Global Analysis of Problems and Solutions"[80]. According to the report, realistic and cost-effective solutions in conservation, sustainable use, restoration, policy and management can help turn the tide for shellfish reefs. Recommended actions include improving protection for reefs of native shellfish; restoring and recovering reefs back to functioning ecosystems that provide multiple services to humans; managing fisheries sustainably for ecosystems and livelihoods; stopping the intentional introduction and

79 Selig ER, Bruno JF (2010) A Global Analysis of the Effectiveness of Marine Protected Areas in Preventing Coral Loss. PLoS ONE 5(2): e9278. doi:10.1371/journal.pone.0009278

80 www.nature.org/shellfish

spread of non-native shellfish; and improving water quality in bays and estuaries. Fundamental to ensuring success of these actions, oyster reefs and other shellfish-dominated habitats need to be managed primarily as critical components of coastal ecosystems, consistent with the ecosystem approach.

Cold water coral reefs

119. Proceedings of the 2nd and 3rd International Symposium on Deep-Sea Corals documented the acceleration in the study of these ecosystems and increasing emphasis on the importance of their protection and management. Much of the attention has focused in the North Atlantic, North-east Pacific and South-west Pacific. There is increasing recent interest in similar ecosystems near developing countries and small island developing States, as well as on high seas seamounts.

120. Major international programmes are expanding knowledge of cold water coral and other deep sea ecosystems. The "Hotspot Ecosystem Research on the Margins of European Seas" (HERMES) project (www.eu-hermes.net) has been an integrated pan-European project with 50 partners funded by the European Commission on cold water coral reefs and other deep-sea habitats, such as cold seeps, anoxic environments, mounds, canyons and continental slopes. HERMES has established strong links with European and global marine policy makers. HERMES concluded in March 2009, with Hotspot Ecosystem Research and Man's Impact on European Seas" (HERMIONE) starting in April 2009. Some of the main findings of HERMES to date include new information about the major role viruses play in global biogeochemical cycles, deep-sea metabolism and overall functioning of deep sea ecosystems[81]; and evidence that commercial fishing in the NE Atlantic could be harming deep-sea fish populations a kilometre below the deepest reach of fishing trawler[82]. HERMES has also produced a set of Deep-Sea Briefs for policymakers addressing issues such as climate change in the deep sea, valuation of ecosystem goods and services, mapping the seafloor, the importance of microbes in the ocean, and deep-sea biodiversity.

121. The Trans-Atlantic Coral Ecosystem Study (TRACES) will establish the first basin-scale study of cold-water coral ecosystems.

122. A Cold-water Coral Reef GIS and database has been developed by UNEP-WCMC using an Interactive Mapping System (IMapS), which provides an internet-based tool for easy access to geo-referenced information on cold-water corals. The database currently consists of over 5,000 records provided by scientists and institutes.

Seamount ecosystems

123. The Global Census of Marine Life on Seamounts (CenSeam) is a global study of seamount ecosystems, to determine their role in the biogeography, biodiversity, productivity, and evolution of marine organisms, and to evaluate the effects of human exploitation on and around seamounts. It is one of the projects undertaken as part of the Census of Marine Life. The project was launched in 2005 and is expected to produce a final report in 2010. The final report is expected to fill critical gaps in our knowledge about seamounts, particularly in understudied regions[83].

124. SeamountsOnline is an information system for seamount biology, and is also the database component of the CenSeam project. Since 2001, SeamountsOnline has been gathering data on species that have been observed or collected from seamounts and providing these data through a freely-available

[81] Danovaro et al. (2008) Major viral impact on the functioning of benthic deep-sea ecosystems. Nature 454, 1084-1087

[82] Bailey et al. (2009) Long-term changes in deep-water fish populations of the north-east Atlantic. Proc.Royal Soc. B, 7 June 2009 vol. 276 no. 1664 1965-1969

[83] CenSeam website at http://censeam.niwa.co.nz/

online portal. It is designed to facilitate research into seamount ecology, and to act as a resource for managers[84]. The map below depicts seamounts for which SeamountsOnline has data.

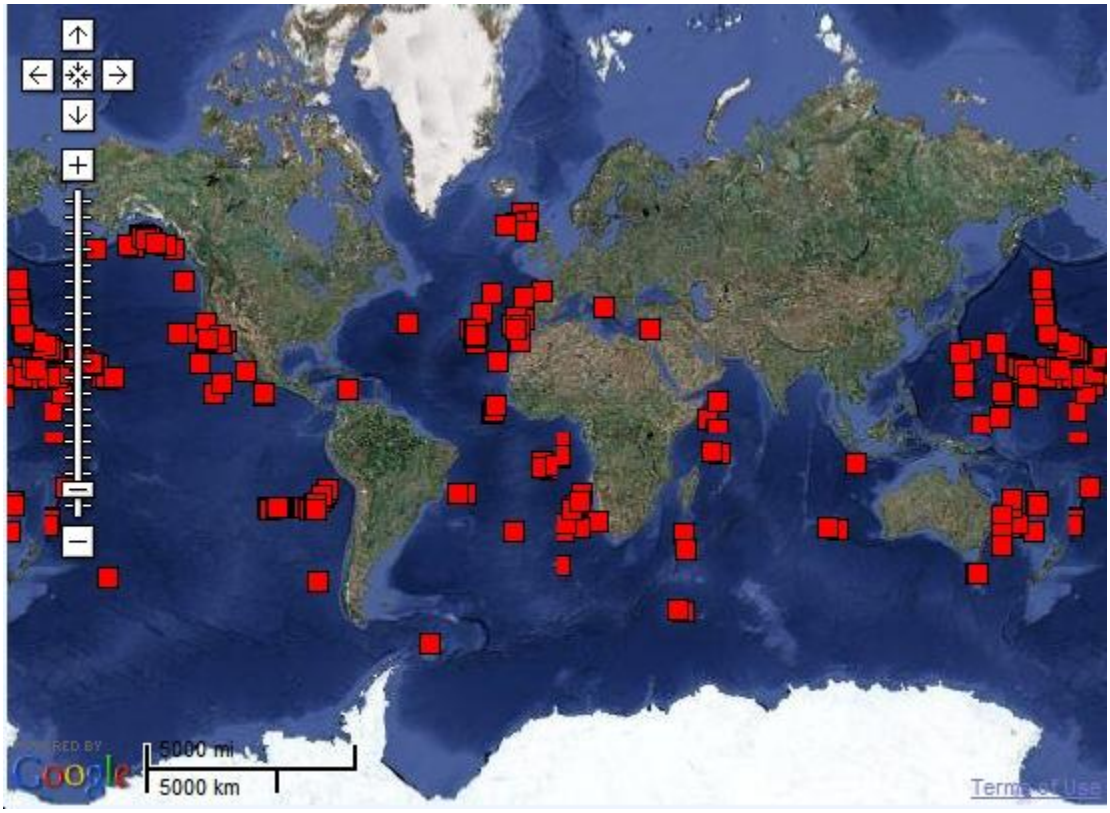


Figure 6: The search interface of SeamountsOnline showing seamounts for which data exist[85].

Operational objective 2.4: To enhance the conservation and sustainable use of biological diversity of marine living resources in areas beyond the limits of national jurisdiction

International efforts in marine areas beyond the limits of national jurisdiction

125. Work towards the conservation and sustainable use of marine living resources in areas beyond the limits of national jurisdiction is taking place through a number of international and regional organisations, conventions and arrangements. These include the United Nations Convention on the Law of the Sea and supplementary agreements on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA) and Deep Seabed Mining; the Food and Agriculture Organisation of the United Nations; the United Nations General Assembly (UNGA); the CBD; the UN Food and Agriculture Organization (FAO); the Convention on International Trade in Endangered Species (CITES); the International Maritime Organization (IMO); the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR); the International Whaling Commission; and the International Convention for the Regulation of Whaling.

84 Stocks, K. 2009. SeamountsOnline: an online information system for seamount biology. Version 2009-1. World Wide Web electronic publication. http://seamounts.sdsc.edu

85 Stocks, K. 2009. SeamountsOnline: an online information system for seamount biology. Version 2009-1. World Wide Web electronic publication. http://seamounts.sdsc.edu

126. In addition, the UNGA established in 2004 the United Nations Ad hoc Open-Ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction (the Working Group). The first meeting of the Working Group, held in 2006, was mandated to: survey past and present activities of the United Nations and other relevant international organizations; examine scientific, technical, economic, legal, environmental, socio-economic and other aspects; identify key issues and questions where more detailed background studies would facilitate consideration by States of these issues; and indicate, where appropriate, possible options and approaches to promote international cooperation and coordination (report contained in document A/61/65). The second meeting of the Working Group, held in 2008, considered more particularly: the environmental impacts of anthropogenic activities on marine biological diversity beyond areas of national jurisdiction; coordination and cooperation among States as well as relevant intergovernmental organizations and bodies; the role of area-based management tools; genetic resources beyond areas of national jurisdiction; and whether there is a governance or regulatory gap, and if so, how it should be addressed (outcome contained in document A/63/79). The following reports of the Secretary-General on oceans and law of the sea have supported the discussions of the Working Group: A/60/63/Add.1 and A/62/66/Add.2. The next meeting of the Working Group will take place in 2010[86].

127. The United Nations Informal Consultative Process on Oceans and Law of the Sea ("the Consultative Process") has considered topics of relevance to marine biological diversity beyond areas of national jurisdiction. These topics have related to responsible fisheries and illegal, unregulated and unreported fisheries; the protection and preservation of the marine environment; the protection of vulnerable marine ecosystems; new sustainable uses of the oceans, including the conservation and management of the biological diversity of the seabed in areas beyond national jurisdiction; ecosystem approaches and the oceans; and marine genetic resources[87].

128. In a more informal setting, the Global Forum on Oceans, Coasts and Islands established in 2005 a Working Group on the high seas and the deep seabed. This group was designed to facilitate multi-stakeholder dialogue in support of the various UN processes, and includes members from a broad range of sectors including national governments, academia, UN agencies, intergovernmental organizations, non-governmental organizations, and industry, representing both developed and developing nations. The group has produced a number of reports to date, ranging from policy and legal issues, to scientific knowledge and potential impacts of climate change in the high seas and deep seabed[88].

129. As recognized in decision VIII/24, the CBD has a key role in supporting the work of the General Assembly with regard to marine protected areas beyond national jurisdiction, by focusing on provision of scientific and, as appropriate, technical information and advice relating to marine biological diversity, the application of the ecosystem approach and the precautionary approach, and in delivering the 2010 target. Accordingly, the CBD is fulfilling this role through the development and adoption of scientific criteria for identifying ecologically or biologically significant marine areas in need of protection in open-ocean waters and deep-sea habitats, and for promoting work relating to review and synthesis of latest scientific information relating to these areas[89], as well as the development of a biogeographic classification system, in response to decision VIII/24 paragraph 44(b), for deep and open ocean areas. The biogeographic classification system will provide a basis for implementation of the ecosystem approach in open and deep ocean areas, including marine spatial planning and the establishment of representative networks of marine protected areas, and will provide a basis for directing further scientific research. While the topic of marine protected areas beyond the limits of national jurisdiction is discussed in more detail in the chapter relating

86 Voluntary report of the UN Division on Ocean Affairs and Law of the Sea (DOALOS) on the implementation of the programme of work on marine and coastal biodiversity

87 Voluntary report of the UN Division on Ocean Affairs and Law of the Sea (DOALOS) on the implementation of the programme of work on marine and coastal biodiversity

88 The Global Forum on Oceans, Coasts and Islands at http://www.globaloceans.org/highseas/index.html

89 CBD Technical Series No. 37: http://www.cbd.int/doc/publications/cbd-ts-37-en.pdf

to marine and coastal protected areas, the box below describes the Global Open Oceans and Deep Seabed (GOODS) Biogeographic Classification.

Box 12. CASE STUDY: The Global Open Oceans and Deep Seabed (GOODS) – Biogeographic Classification

A new biogeographic classification of the world's oceans has been developed which includes pelagic waters subdivided into 30 provinces as well as benthic areas subdivided into three large depth zones consisting of 38 provinces (14 bathyal, 14 abyssal and 10 hadal). In addition, 10 hydrothermal vent provinces have been delineated. This classification has been produced by a multidisciplinary scientific expert group, who started this task at the workshop in Mexico City in January 2007. It represents the first attempt at comprehensively classifying the open ocean and deep seafloor into distinct biogeographic regions. The classification is displayed in figures 1 (pelagic), 7, 8, 9 (benthic) and 10 (hydrothermal vents).

This work is hypothesis-driven and still preliminary, and will thus require further refinement and peer review in the future. However, in its present format it provides a basis for discussions that can assist policy development and implementation in the context of the CBD and other fora. The classification was presented to both SBSTTA-13 and COP-9, and was noted by COP in decision IX/20.

Source: UNESCO. 2009. Global Open Oceans and Deep Seabed (GOODS) – Biogeographic Classification. Paris, UNESCO-IOC. (IOC Technical Series, 84.)

Scientific research and improving the information basis

130. Even though progress is being made in regards to biogeographic classification and other scientific initiatives, scientific information regarding marine areas beyond the limits of national jurisdiction is still severely lacking. Initiatives such as the Census of Marine Life and its CenSeam project, the European HERMES project (both described in more detail in the previous section) and the Global Procellariiform Tracking Database, managed by BirdLife International[90] have contributed greatly to our understanding of these remote areas. In addition, UNEP and IUCN have both contributed through compiling scientific and other information in policy-relevant formats in a number of reports[91]. UNEP-WCMC has also created a Geographic Information Systems Database for marine areas beyond the limits of national jurisdiction[92].

131. The International Seabed Authority (ISA) and the FAO have conducted research relevant to biodiversity in marine areas beyond the limits of national jurisdiction. FAO collects statistics and information and develops databases on capture fisheries, including high seas and deep-sea fisheries, while ISA has undertaken research on impacts of deep seabed mining. For example, the ISA submitted to the UN Working Group in 2008 a report titled "biodiversity, species range and gene flow in the abyssal Pacific nodule province: predicting and managing the impacts of deep seabed mining"[93].

132. Of interest is also a recent UNEP-WCMC report titled Deep-sea biodiversity and ecosystems: A scoping report on their socio-economy, management and governance[94]**.** The objective of this report is to

90 BirdLife International (2004) *Tracking Ocean Wanderers: the global distribution of albatrosses and petrels*. Cambridge, UK: Birdlife International (results from the Global Procellariiform Tracking Workshop, 1–5 September 2003, Gordon's Bay, South Africa).

91 http://www.unep-wcmc.org/resources/publications and http://www.iucn.org/about/work/programmes/marine/

92 http://bure.unep-wcmc.org/marine/coldcoral/viewer.htm

93 http://www.un.org/Depts/los/biodiversityworkinggroup/biodiversityworkinggroup.htm

94 http://www.unep-wcmc.org/resources/publications/UNEP_WCMC_bio_series/28.aspx

provide an overview of the key socio-economic, management and governance issues relating to the conservation and sustainable use of deep-sea ecosystems and biodiversity. The report is notable because socio-economic information, in particular, has been lacking for marine areas beyond the limits of national jurisdiction. While the report touches on economic valuation, it notes that our limited knowledge of the deep sea also affects our capacity to put values on its ecosystems and the goods and services they provide. For example, while there is some information about the contribution of certain deep-sea habitats to goods and services in the form of nutrient cycling, primary production, and food, there is very little knowledge about the role of these habitats in climate regulation and in building or maintaining ecosystem resilience.

Status of implementation

133. While it is evident from the above that there is a need for further scientific information about deep and open ocean areas beyond national jurisdiction, threats to these environments from fishing, mining, oil and gas exploration, pollution, climate change and other sources still continue, and will need to be managed based on best available science. The impacts arising from bottom fishing on seabed habitats are now being dealt with by Regional Fisheries Management Organizations (RFMOs) in accordance with UN General Assembly Resolution 61/105. However, efforts to minimise the impact of fisheries on non-target, associated and dependent species, including seabirds, sea turtles and sharks still need to be strengthened. Additionally, illegal, unregulated and unreported (IUU) fishing continues in the high seas, with impacts on biodiversity, including both target and non-target species. The issue is addressed by multilateral fisheries management forums, including the UN General Assembly, the UN Food and Agriculture Organisation's Committee on Fisheries (FAO-COFI), the High Seas Task Force (HSTF) and within RFMOs. At the present time, IUU fishing threatens to undermine any fledgling efforts of application of the ecosystem approach to the management of marine areas beyond the limits of national jurisdiction. As the case study below demonstrates, even the advanced implementation of the ecosystem approach to the management of marine living resources in the CCAMLR area can be made vulnerable to the impacts of IUU fishing. The case study also demonstrates the need for collaboration and coordination between agencies dealing with fisheries management and those dealing with biodiversity.

Box 13. CASE STUDY: IUU fishing in the CCAMLR area

During the past decade, the incidence of IUU fishing has grown at an alarming rate within the Convention Area and adjacent areas. Substantial catches of toothfish (*Dissostichus* spp.) have been taken by longline fishing and, in more recent years, by gillnet fishing. CCAMLR estimates of IUU fishing are well in excess of allowable catches agreed by CCAMLR.

The high incidence of IUU fishing has not only had a detrimental effect on toothfish stocks, particularly in the Indian Ocean, it has impacted heavily on seabird populations to the extent that the future sustainability of both groups has been called into question. The continued lack of information from IUU fisheries undermines CCAMLR's conservation measures and severely complicates efforts to determine future toothfish stock trends in certain areas with any level of certainty.

CCAMLR has responded to the threat of IUU fishing by adopting a number of conservation measures. In addition, CCAMLR has implemented a Catch Documentation Scheme, reviews information on IUU fishing activities in the Convention Area annually, and has established a List of IUU Vessels of Contracting and non-Contracting Parties. Together, these initiatives have contributed to a significant overall decline in IUU fishing since 2003. However, some areas still remain vulnerable.

Source: CCAMLR website (http://www.ccamlr.org/pu/E/sc/fish-monit/iuu-intro.htm)

Conclusions

134. Countries have undertaken a large number of activities for the conservation and sustainable use of marine and coastal living resources. In fact, such activities, along with the establishment of MCPAs, are probably some of the most common ones undertaken to implement the CBD. Regardless, the increasing human and development pressures in coastal areas serve as drivers of unsustainable use and cause degradation of habitats, compounded by poverty and impacts of climate change. Achieving sustainable use in the face of these pressures is difficult, as demonstrated by the decline experienced by many species and ecosystems. Additionally, living resources in deep and open oceans are relatively under-protected when compared to those in coastal areas. It should also be noted that the CBD programme of work on marine and coastal biodiversity does not presently address the impacts of climate change beyond activities related to coral bleaching.

Programme element 3: Marine and coastal protected areas

Operational objective 3.1: To establish and strengthen national and regional systems of marine and coastal protected areas integrated into a global network and as a contribution to globally agreed goals.

Global status and trends of MCPA establishment

135. The most up-to-date information about marine and coastal protected areas (MCPAs) can be found in the World Database on Marine Protected Areas (http://www.wdpa-marine.org/Default.aspx), which is maintained by UNEP-WCMC. Data for 2009 regarding numbers of MCPAs and area protected globally is not yet completely finalized, and there is still some discrepancy about methods of calculation (such as whether international or only national MCPAs are included and how EEZs are defined in light of extended continental shelf claims). The best currently available information for 2009 indicates that 6.3% (1.39 million km^2) of territorial seas are protected, which is an increase from 5.0% in 2000 and 2.9% in 1990. Overall, however, only 0.5% of the oceans globally are protected. Slightly older statistics from March 2008 show that there were an estimated 4435 MCPAs worldwide at that time. Of the total area of MCPAs, a minority, or 12.8% does not allow extractive activities [95[1][1]]. From these statistics it is evident that although the coverage of MCPA is increasing, overall the world's oceans and coastal areas are still under-protected. Figure 7 shows the location and extent of currently existing MCPAs, as displayed in the World Database on Marine Protected Areas.

95[1] Wood, L.J., Fish, L., Laughren, J. and Pauly D. (2008) Assessing progress towards global marine protection targets: shortfalls in information and action. Oryx 42: 340-351

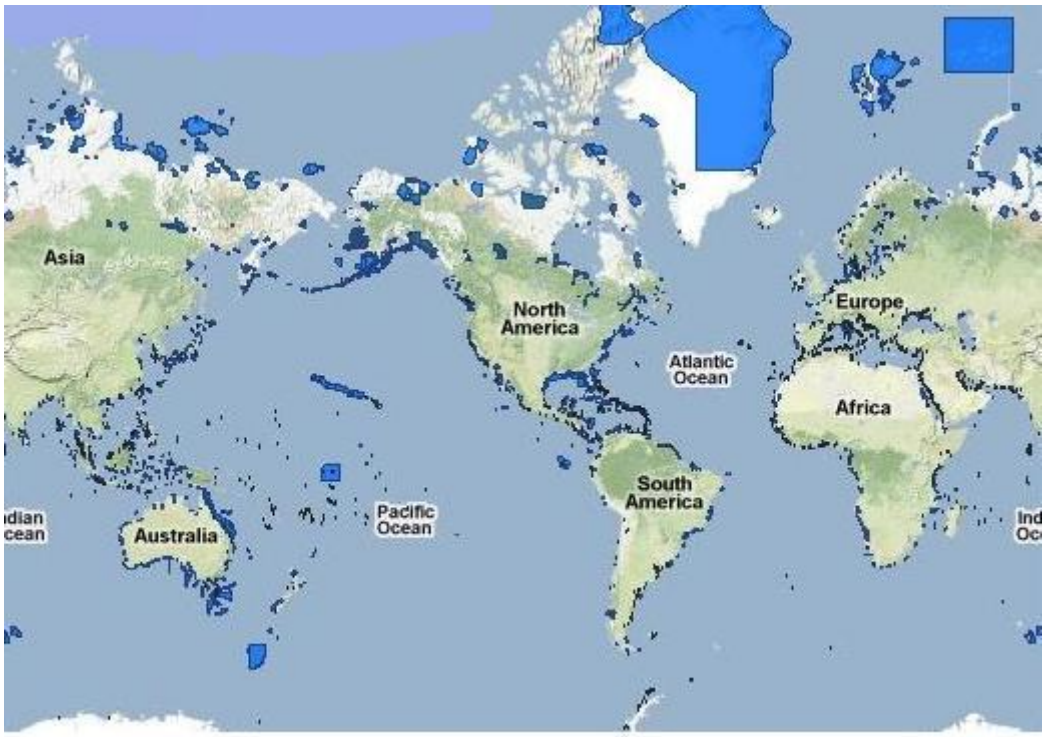


Figure 7: Global distribution of MCPAs. (Source: World Database of Marine Protected Areas http://www.wdpa-marine.org)

136. A number of regions have also developed their own MCPA databases, which are compatible with the WDPA. For example, based on their national reports, the Northwest Pacific Action Plan (NOWPAP) member states have established a database on marine and coastal reserves in 2007, providing information about 53 nature reserves (among 108 in total) in the NOWPAP region. Similarly, the UNEP Regional Seas Caribbean Environment Programme has developed a web-based MPA database that has, for each of the approximately 300 MPAs of the Wider Caribbean, 77 fields with information on identity, biophysical features, legal framework and management tools, (http://cep.unep.org/caribbeanmpa). The work was undertaken as part of its regional MPA Management Network and Forum, known as CaMPAM (http://www.campam.gcfi.org/).

137. The trend towards establishing new MCPAs is clearly evident from the CBD national and voluntary reports. In the 2005 3rd National Reports, 94.12% of all Parties stated that their future plans included the development of new MCPAs. The 2008/2009 voluntary reports on marine and coastal biodiversity, as well as the 2009 4th National Reports received to date indicate that all reporting coastal countries have established either one or several new MCPAs, and in some cases have developed national networks. In many cases the coverage of MCPAs achieved to date is impressive. For example, Cuba reports protection of 25% of the marine platform as well as 57% of coral reefs.

138. This trend is likely to continue in the future, as many countries have established targets related to MCPAs and networks. Often the goal is to protect 10-30% of marine and coastal habitats, or to target specific ecosystem types, such as coral reefs. For example, Belize has a conservation target of 20% for all marine and coastal bioregions, 30% for reefs, 80% for spawning aggregations and 60% for turtle nesting sites. France aims to protect 10% of its maritime space by 2012 and 20% by 2020, amounting to a total of 11 million km^2 of sea. The Micronesia Challenge, which aims to conserve at least 30% of near-shore

marine resources in Micronesia by 2020, will eventually ensure protection for 6.7 million km^2, or five per cent of the entire Pacific Ocean.

Efforts towards establishing new MCPAs

139. The recent 2008/2009 voluntary thematic and national reports provide some information about new MCPAs that have been established worldwide. For example, Niue reports the establishment of an additional marine protected area as an initiative of the International Waters Programme (IWP) on the western side of the island. Sri Lanka reports the establishment of two marine protected areas containing coral reefs (Hikkaduwa National Park and the Bar Reef Marine Sanctuary). China reports on the establishment of 50 local marine nature reserves and 11 special marine protected areas over the past several years. Cameroon reports on new proposed marine protected areas (Bakassi Peninsula Mangroves, Douala Edea Fauna Reserve, Rio del Rey), the creation of which has long been a priority. Guinea reports on three coastal Ramsar sites. Ivory Coast is in the process of conducting studies to identify MPA sites. Estonia is developing a comprehensive network of marine and coastal protected areas, including spawning and nursery areas. Bulgaria reports the development of Indicative Ecologically Coherent Network of Sub-tidal Marine Protected Areas in Bulgaria and Romania.

140. Notable progress was also made by the recent declaration of two very large MCPAs, protecting vast amounts of biodiversity. The Papahānaumokuākea Marine National Monument was upgraded to highly protected status by the USA in 2006 to take in the 356,893 km^2 of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, designated in 2000. The Government of Kiribati, with help from major NGOs, has created the marine protected area by enlarging the Phoenix Islands Protected Area (PIPA), in January 2008, to encompass 410,500 km^2. In March 2010, the U.K. designated the Chagos Islands, a group of 55 islands in the middle of Indian Ocean, as the world's largest marine reserve. The islands and their surrounding waters cover 544,000 km^2.

141. In 2008, the World Heritage Commission listed 6 large areas of New Caledonia for special protection. They acknowledge that the coral reefs included in these areas are of global significance with a large concentration of biodiversity resources. The Republic of the Marshall Islands intends to seek World Heritage recognition for 9 atolls and one low reef island in 2009, and the government of Thailand is investigating a similar proposal for large areas of the Andaman Sea coast with substantial coral reefs[96].

142. At the World Ocean Conference 2009, Indonesia announced the 3.5 million hectare Savu Seas Marine National Park in the Savu Sea, Indonesia. This marine park will be the largest in South East Asia and is situated on a major migration route for 14 whale species including the rare blue whale. It is also an important spawning area for tuna, the stocks of which are critically in danger of collapsing. Savu Seas NMP will build towards Indonesia's commitment to having over 10 million ha of marine reserve by 2010.

Efforts towards establishing MCPA networks

143. Examples from the recent 2008/2009 national and voluntary reports to the CBD include a number of national MCPA networks in the process of being planned and under development, for example in Australia, Estonia, Canada, Spain, Portugal, Brazil and Colombia, amongst others. In most cases these networks have stated objectives of being both representative and comprehensive. Some of these networks are already well advanced. For example, the Nationally Representative System of Marine Protected Areas in Australia now covers 900,000 square kilometers of marine space, while Spain reports 251.139 hectares of protected marine area. In other cases, these networks are sub-national, aimed at protecting specific ecological regions in a country, for example the Red de Reservas Naturales Urbanas de Patagonia in Argentina.

96 Wilkinson, C. (2008) Status of coral reefs of the world: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia, 296 p.

144. Europe has some ten agreements and initiatives that are promoting MPA networks and providing an institutional framework for a regional approach, including: the Habitats Directive and the Birds Directive, with the associated Natura 2000 programme in the EU states; the Bern Convention and associated Emerald Network in the EU states, other European countries, and some African countries; the Mediterranean and Black Sea UNEP RSPs and associated Conventions; OSPAR and HELCOM; and the North Sea Conference. Regional MPA network planning is well advanced in the Baltic Sea and North-East Atlantic through the HELCOM and OSPAR processes, and these initiatives are stimulating and accelerating national efforts[97]. For example, most European countries, including Germany, Belgium, Poland, Finland, Sweden, Spain, Italy and Portugal are establishing national sites and networks under these initiatives. The example of Sweden, in the box below, illustrates a national example in the European context.

Box 14. CASE STUDY: Marine protected areas in Sweden

In accordance with the environmental quality objective, 28 marine protected areas shall be established by 2010. Within the period from 2007 to 2008, nine new marine nature reserves have been established, increasing the total of marine reserves to 21 sites in 2008.The marine nature reserves cover approximately 2% of the territorial waters. The Natura 2000 network extends the network of marine protected areas to approximately 6% of the territorial waters. In June 2008, the Swedish government proposed four new offshore areas to the European Commission, improving the protection in the Exclusive Economic Zone from 1 to 3.5 percent. According to the environmental quality objective, Sweden shall establish 6 no-fishing areas by 2010. In November 2008 the Swedish and Danish ministries of fisheries agreed upon the closure of the most important spawning habitat for cod in the Kattegatt area.

Source: Sweden's voluntary report on the implementation of the programme of work on marine and coastal biodiversity

145. The Sociedade Portuguesa para o Estudo das Aves (SPEA)[98] and the Sociedad Española de Ornitología (SEO)[99] both conducted 4-year EU LIFE funded projects (2004–2008) which identified the most significant marine areas for seabirds within the Macaronesia region. The sites were identified as Important Bird Areas (IBAs), for promotion as Special Protection Areas (SPAs) under the Natura 2000 network. Similar projects have developed in other European countries (e.g. in the Baltic Sea, Italy, France, Malta and Greece) using the same methodologies.

146. Both projects collected information on seabird species distribution (through tracking studies and transect surveys) as well as oceanographic variables (e.g. temperature, productivity, currents etc.) and investigated the relationship between them. Jointly, their marine IBA inventories include 59 marine IBAs, 42 of which are in Spain (42,584 km²) and 17 in Portugal (14,551 km²). In addition, both projects have identified areas of interest away from their national jurisdictions, both in other countries' territories and in international waters. These projects illustrate the need for international collaboration, including working with international agreements, in order to create networks of MCPAs that should ensure the protection of seabirds and other marine biota.

147. At the regional level, MCPA network planning and establishment has been undertaken through a multi-country collaborative process. According to a recent UNEP review of national and regional

97 Source: UNEP-WCMC (2008). National and Regional Networks of Marine Protected Areas: A Review of Progress. UNEP-WCMC, Cambridge.

98 http://lifeibasmarinhas.spea.pt/y-book/ibasmarinhas/

99 www.seo.org/programa_intro.cfm?idPrograma=32

networks of marine protected areas[100], regions with a strong co-ordinating framework and supporting treaty or agreement, such as those participating in Regional Seas Programmes (RSP), have generally progressed the furthest. As is evident from the paragraphs above, the various European Union directives and European agreements have also promoted tremendous progress in Europe.

148. The UNEP-RSP regions for East Africa, the North-East Pacific, South-East Pacific, and Wider Caribbean also have Protocols specifically aimed at promoting the establishment of MPAs. Some have Regional Activity Centres or other bodies to undertake the activities necessary to promote a collaborative approach and establish regional networks of organisations and individuals, such as the Wider Caribbean with the SPAW programme, and the Mediterranean with its extensive MPA programme. The ROPME Sea is working on the development of an MPA programme. The more recently created RSPs, such as the North- West Pacific and South Asian Seas, plan to address MPAs in the near future or have MPA related activities under development[101].

149. Discussions are also underway concerning the urgent need for MPA networks in the Antarctic and Arctic. In the Arctic, the management plan for the marine environment of the Barents Sea and sea areas off Lofoten (almost 1.4 million km^2) is the first comprehensive regional management plan and was approved in 2006. The overall framework for existing and future activities in the sea area is delineated in the management plan, and arrangements for coexistence between industries such as fisheries, sea transport, and petroleum prospecting and extraction put in place[102].

150. A regional overview on MCPAs in the Northwest Pacific (NOWPAP) region indicates that 108 marine and coastal marine reserves were designated by the four member states (China, Japan, Korea and the Russian Federation) within the geographical area of NOWPAP, which cover most typical and unique ecosystems including estuaries, intertidal zone, islands, salt marshes, and rocky and sand beaches. The member states have laws and regulations related to marine and coastal biodiversity conservation. However, they consider this number of reserve is still inadequate to protect the complexity of diverse species and ecosystems[103].

151. The network developed under the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA) includes 12 MPAs in Iles des Sept Frères and Ras Siyan (Djibouti); Ras Mohammed National Park; Giftun Islands and Straits of Gubal (Egypt); Aqaba coral reefs (Jordan); Straits of Tiran; Wajh Bank, Sharm Habban and Sharm Munaybirah; Farasan Islands (Saudi Arabia); Aibat and Saad ad-Din Islands, Saba Wanak (Somalia); Sanganeb Marine National Park; Mukkawar Island and Dungonab Bay (Sudan); Socotra Islands; Belhaf and Bir Ali area (Yemen). A Regional Master Plan forms an agreed-upon framework for the planning and management of each MPA in the regional network.

152. Regional initiatives are also being initiated through agreements directly between countries, often supported by NGOs. These tend to be based on ecoregions, including Large Marine Ecosystems (LMEs), seascapes, or the protection of a certain biodiversity rich areas within LMEs, such as the Golfo de Fonseca mangrove area off the coast of Nicaragua, Honduras, and El Salvador. Smaller regional networks can be successfully nested within larger ones, as was done, for example, in South-East Asia where several nested network initiatives are currently being supported and co-ordinated through the much larger

100 Source: UNEP-WCMC (2008). National and Regional Networks of Marine Protected Areas: A Review of Progress. UNEP-WCMC, Cambridge.

101 Source: UNEP-WCMC (2008). National and Regional Networks of Marine Protected Areas: A Review of Progress. UNEP-WCMC, Cambridge.

102 Norway's 4th National Report

103 NOWPAP voluntary report on the implementation of the prorgamme of work on marine and coastal biodiversity

initiative involving six countries[104]. The box below contains examples of regional networks involving two or more countries.

Examples of regional networks of MCPAs involving two or more countries

Region	Countries	Progress
Mesoamerican Barrier Reef	Mexico, Belize, Guatemala, Honduras	NTAs and multiple use; several initiatives underway to develop the network with support of TNC and WWF
Gulf of Mexico 'Islands in the Stream'	USA, Mexico, Belize	Early proposal
North-east Pacific	Countries from Mexico south to Colombia	Proposal developed
South-east Pacific	Countries from Panama south to Peru	Recommendation; to include MPAs and MCPAs
Tropical Eastern Pacific Marine Corridor Network (CMAR - or Corredor Marino)	Colombia, Costa Rica, Panama, Ecuador - San Jose Declaration	Implementation of network of five existing MPAs underway
Baja California to the Bering Sea (B2B)	USA, Canada, Mexico	28 sites identified
Scotian Shelf/Gulf of Maine	Canada, USA	
Eastern African Marine Ecoregion (EAME) Programme	Somalia, Kenya, Tanzania, Mozambique, South Africa	Priority 'seascapes' identified and ranked by WWF and support provided to protect some of these
MPA Network for the Countries of the Indian Ocean Commission	Madagascar, Mauritius, France (Reunion), Comores, Seychelles	Data-gathering underway
Western Africa Regional Network	Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, and Cape Verde	Initial steps underway
PERSGA MPA Network	Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan and Yemen	Master Plan for the network prepared and some sites established
Caspian regional MPA Network	Azerbaijan, Islamic Republic of Iran, Kazakhstan, the Russian Federation and Turkmenistan	Initial discussions underway
South-east Asian MPA network	ASEAN and other countries	Action Plan prepared
Sulu-Sulawesi Marine Ecoregion (SSME)	Indonesia, Malaysia, Philippines	Framework for network developed with criteria for site selection
Natura 2000	Member countries of the EU	Under development and many sites established
Mediterranean	All countries bordering Mediterranean	Under development; to be comprised of several sub-regional networks
OSPAR	Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK	Criteria and guidelines developed and process well underway; sites currently being nominated
HELCOM	Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russian Federation, Sweden	Criteria and guidelines developed and process well underway; sites currently being nominated

[104] Source: UNEP-WCMC (2008). National and Regional Networks of Marine Protected Areas: A Review of Progress. UNEP-WCMC, Cambridge.

Antarctic	25 members of CCAMLR	Planning underway for a regional MPA system
Arctic	Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, USA	Discussions underway for an MPA network

Source: UNEP-WCMC (2008). National and Regional Networks of Marine Protected Areas: A Review of Progress. UNEP-WCMC, Cambridge.

Representativity

153. The Johannesburg Plan of Implementation paragraph 32(c) calls for the establishment of representative networks of marine protected areas. The notion of representativity is also echoed more implicitly in CBD target 1.1. According to recent estimates, most marine and coastal protected areas are on the continental shelf and in coastal waters. An estimated 6.3% of territorial seas are protected, while only 0.5% of oceans overall are in MCPAs (see also figure 7). According to best available information, approximately 43% of all MCPAs (or about 65% of the total area that is protected) lie in the tropics (between 30°N and 30°S), with most of the remainder in the northern hemisphere. Intermediate latitudes (20°N to 50°N) and the southern temperate and polar latitudes are least well represented105.

154. Coral reefs and mangroves seem to be the best protected ecosystems, with an estimated 15-22% of the area of the world's reefs protected, 17% of mangroves, 10% of seagrasses and 2% of seamounts106. This seems to indicate that the 10% global target for coral reefs, mangroves and seagrasses has been reached. However, further analyses would be needed to ensure that all important coral reefs and other ecosystems around the world have adequate protection, and that the 10% figure is high enough in the face of climate change, development pressures and other related threats, such as ocean acidification and coral bleaching. These threats will likely disproportionately affect coral reefs. It should be noted that many scientific publications recommend figures much higher than 10%, although ugh the appropriateness of a target would also depend greatly on how sustainably the area outside the MCPA is managed.

155. As is evident from the above, deep sea and open ocean habitats are generally under-represented in MCPAs. Recently, however, a number of countries have declared marine protected areas to protect seamount and other deep sea habitats. For example, in 2007 the Australian Government established the South-East Commonwealth Marine Reserve Network to contribute to the NRSMPA. The South-East network is the first temperate deep sea network of marine reserves in the world. It covers 226,458 square kilometres and includes representative examples of the diverse seafloor features and associated habitats found in the South-East Marine Region. The reserves include striking features such as underwater canyons and sea mounts, and the diverse marine life associated with them, some of which is new to science and found nowhere else in the world.

156. During the same year, the Australian Government moved to incorporate the Tasman Seamounts Marine Reserve into the Huon Commonwealth Marine Reserve which is part of the greater South-East marine region. The Huon Commonwealth Marine Reserve covers about 9,991 square kilometres of Commonwealth ocean territory to the south of Tasmania and includes a broad depth range from the inner continental shelf in about 70 metres to over 3,000 metres. The majority of the area is in deep water. Huon Commonwealth Marine Reserve contains a remarkable cluster of seamounts, which are habitat for a

105 Wood, L.J., Fish, L., Laughren, J. and Pauly D. (2008) Assessing progress towards global marine protection targets: shortfalls in information and action. Oryx 42: 340-351

106 Wood, L.J., Fish, L., Laughren, J. and Pauly D. (2008) Assessing progress towards global marine protection targets: shortfalls in information and action. Oryx 42: 340-351

diverse number of plants and animals. On the seabed there are a large number of endemic species and large erect corals and sponges. In certain locations seamounts are believed to provide stepping stones in trans-oceanic dispersal of the microscopic organism larvae of sea bottom dwelling species. The seamounts of the Huon Marine Reserve provide an important connection between seamounts of the Indian Ocean and the Tasman Sea[107].

157. The closure of 19 seamounts to bottom trawling and dredging by New Zealand in 2001 was recently expanded with 17 new Benthic Protected Areas (BPAs) in the New Zealand EEZ. These areas cover 1,200,000 km^2, about 30% of the EEZ. The network was proposed by the New Zealand fishing industry and adopted by the government in November 2007. The main objective was to protect pristine benthic ecosystems where there has been little or no fishing[108].

158. South Africa has developed the Offshore Biodiversity Initiative (OBI) as a flagship project of the Marine Programme. One of the outputs from this project is the publication of Guidelines for Offshore Protected Marine Areas in South Africa . In Canada, cold-water coral conservation initiatives include the existing Gully Marine Protected area, the newly established Bowie Seamount Marine Protected Area as well as fisheries-based coral/sponge conservation areas on Atlantic and Pacific coasts[109]. Spain declared in 2008 its first offshore marine protected area, el Banco del Cachucho, which became a part of the OSPAR Network of Marine Protected Areas in the North-East Atlantic (see description in the box below). Belgium, which has a number of marine and coastal protected areas inside its territorial waters, has commissioned a study to select additional marine protected areas in the EEZ to further contribute to the Natura 2000 network and its national network of MPAs. Many countries have noted the need to delineate off-shore MPAs in their EEZs, but also note the difficulty of managing and enforcing MPAs so far away from the shore.

Box 15. CASE STUDY: El Cachucho Marine Protected Area

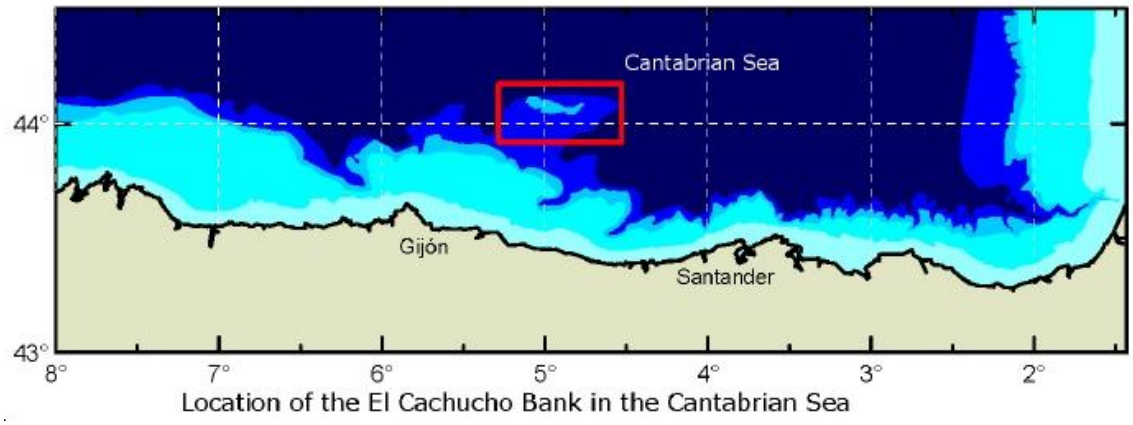
El Cachucho (also known as the Le Danois Bank) is an extensive offshore bank and seamount with surrounding slopes and a complex system of channels and canyons that covers 234 000 ha. The area to be protected also includes an ecologically valuable inner Basin separating the Bank from the continental shelf. Depths within the area vary from 500 – 4000 m – an amazing diverse biological hot-spot. The area of El Cachucho has been declared by the Spanish Government, supported by the Asturian Regional Government and this will be the first MPA created under the new Spanish law for Natural Heritage. The area was added to the Network of Marine Protected Areas of the OSPAR Commission. The OSPAR Commission is committed to establishing a coherent well-managed Network of Marine Protected Areas throughout the North-East Atlantic by 2010. Momentum to protect more areas is gathering within the whole OSPAR Maritime Area.

Of real interest to marine scientists are important populations of deep sea sponges within the El Cachucho area. Some gigantic cup-shaped sponges are over 1m high and over 100 years old. Within the inner Basin there are up to 750 sponges per hectare. Deep water sharks and other species found on El Cachucho are vulnerable to fishing. In addition, the inner Basin is home to giant squid, extraordinary creatures which may weigh up to 950kg and measure 14m. Already two new species to science have been identified.

107 Australia's voluntary report on the implementation of the programme of work on marine and coastal biodiversity.

108 Wilkinson, C. (2008) Status of coral reefs of the world: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia, 296 p.

109 Canada's voluntary report on the implementation of the programme of work on marine and coastal biodiversiyt



Source: OSPAR voluntary report on implementation of the programme of work on marine and coastal biodiversity

159. In addition, Regional Fisheries Management Organizations (RFMOs) are identifying vulnerable marine ecosystems and closing them to bottom fishing. For example, The Northwest Atlantic Fishery Organization (NAFO) adopted bottom fishing closures on five seamounts. Four closures have been implemented, while the fifth will be closed as of 2009. The Northeast Atlantic Fisheries Commission (NEAF) prohibited in 2004 bottom trawling and fishing with static gear on four seamounts and a section of the Mid-Atlantic Ridge. Additional areas were closed or modified in 2007 and 2008. The Southeast Atlantic Fishery Management Organization (SEAFO) identified in 2006 13 vulnerable areas (mostly seamounts) and closed 10 to all bottom-fishing for an interim period. The Central Atlantic and Southwest Atlantic area is outside national jurisdiction[110].

160. Despite these efforts, deep sea habitats are still under-protected globally and will require further attention in the future. Even more under-protected are open ocean pelagic ecosystems, where fewer protected areas exist than in any other ecosystem on Earth. Some pelagic protected areas or restricted access areas exist to limit pelagic fishing (for example in the Gulf of California and around the dynamic distribution of southern bluefin tuna habitat off the east coast of Australia, where a restricted access area is adjusted according to oceanographic parameters for the purposes of managing interactions between two fisheries) and for the protection of marine mammals (for example the Pelagos Marine Sanctuary in the Mediterranean). However, it is likely that <0.1% of pelagic habitat is currently protected[111].

Operational objective 3.2: To enhance the conservation and sustainable use of biological diversity in marine areas beyond the limits of national jurisdiction

Status and trends in MPAs beyond national jurisdiction

161. While very few marine protected areas presently exist beyond national jurisdiction, work is underway to identify potential sites and to develop the scientific background to support site selection. The presently existing MPAs include the Pelagos Sanctuary for Mediterranean Marine Mammals and measures taken by Regional Fisheries Management Organizations (RFMOs) and arrangements to

110 Wilkinson, C. (2008) Status of coral reefs of the world: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia, 296 p.

111 Edward T. Game, Hedley S. Grantham, Alistair J. Hobday, Robert L. Pressey, Amanda T. Lombard, Lynnath E. Beckley, Kristina Gjerde, Rodrigo Bustamante, Hugh P. Possingham and Anthony J. Richardson (in press) Pelagic protected areas: the missing dimension in ocean conservation. TREE-1080

implement the United Nations General Assembly Resolution 61/105 to protect vulnerable marine ecosystems (VMEs) from high seas bottom fishing. The Northwest Atlantic Fisheries Organization (NAFO), NEAFC, CCAMLR and SEAFO have closed some areas where VMEs are known or likely to occur, and interim measures have been adopted in the Northwest Pacific and South Pacific. While the extent of VMEs closed to bottom fishing to date is far from comprehensive, the actions taken by these RFMOs demonstrate an effort in a positive direction.

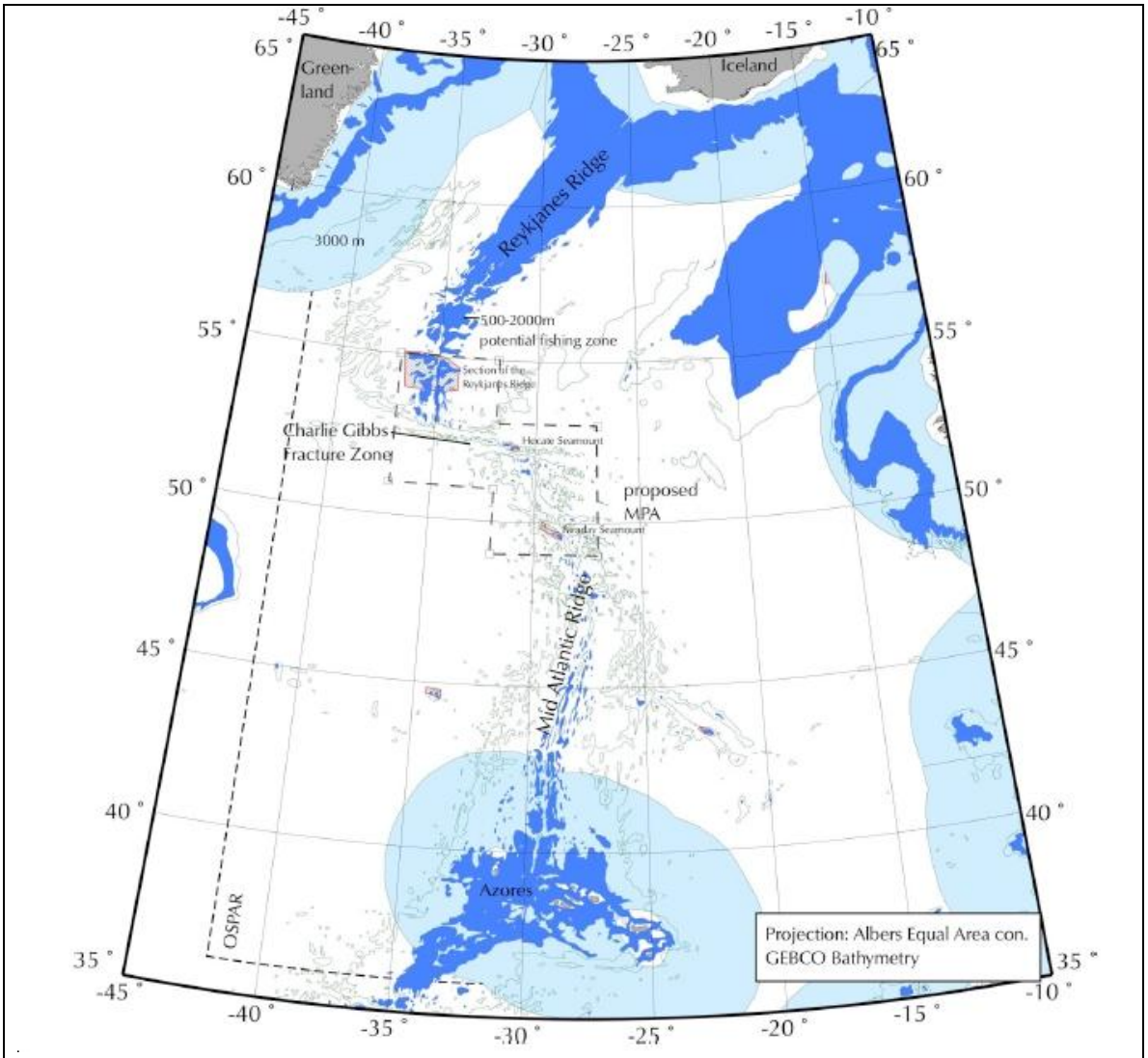
Regional initiatives

162. A number of regional initiatives are well on their way to identify marine protected areas beyond the limits of national jurisdiction. For example, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) has now adopted broad-scale bioregional classifications for both the pelagic and benthic environments of the Southern Ocean. The pelagic bioregionalisation maps have been used to define priority areas in which further work to identify systems of marine protected areas should now be focused.[112] In 2008, the Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention) welcomed the proposal for establishing an MPA on the Mid-Atlantic Ridge/Charlie Gibbs Fracture Zone (CGFZ) presented by WWF, the Netherlands and Portugal (see box below). The need to protect areas that fall beyond national jurisdiction is also contemplated as part of the Agulhas and Somali Current Large Marine Ecosystems project. Management action in these areas will be taken in the context of the ecosystem approach, and there is a need to ensure that even those areas that fall beyond national jurisdiction are managed as part of the Large Marine Ecosystem. While no concrete proposals in terms of marine protected areas beyond national jurisdiction exist to date for this area, the need to manage large marine ecosystems in their entirety has been recognized by the project.

Box 16. CASE STUDY: Proposed MPA at Mid Atlantic Ridge/Charlie Gibbs Fracture Zone (CGCFZ)

The Mid Atlantic Ridge/Charlie Gibbs Fracture Zone is proposed for inclusion in the OSPAR network of marine protected areas, and is the first area beyond the limits of national jurisdiction to be considered as a site in the network. The proposed area covers the northern part of the Mid-Atlantic Ridge, including the Charlie-Gibbs Fracture and Maxwell Fracture Zones. The proposed area comprises the seamounts Faraday (1251 km2) and Hecate (358 km2), and in the north a section of the Reykjanes Ridge (20,644 km2) where bottom trawling and fishing with static gear, including bottom set gillnets and longlines, has been prohibited since 2004. On the slopes of the seamounts and hills, the suspension feeding fauna includes a wide range of cold-water coral and sponge species with associated communities. The enhanced production in the pelagic area attracts a number of fish, whales, dolphins and sea turtles.

112 SC-CAMLR XXVII. 2008. Report of the Twenty-seventh Meeting of the Scientific Committee for the Conservation of Antarctic Marine Living Resources. Hobart, Australia.



Source: OSPAR voluntary report on the implementation of the programme of work on marine and coastal biodiversity

Developing the scientific basis for selecting new marine protected areas

163. Progress was also made by the CBD Parties through the adoption of decision IX/20, which contains scientific criteria for identifying ecologically or biologically significant marine areas in need of protection in open-ocean waters and deep-sea habitats. The criteria include uniqueness or rarity; special importance for life-history stages of species; importance for threatened, endangered or declining species and/or habitats; vulnerability, fragility, sensitivity or slow recovery; biological productivity; biological diversity; and naturalness. In addition, the Parties adopted scientific guidance for selecting areas to establish a representative network of marine protected areas, including in open-ocean waters and deep-sea habitats. The required network properties and components include ecologically and biologically significant areas; representativity; connectivity; replicated ecological features; and adequate and viable sites. The next challenge is to use these criteria to identify sites in marine areas beyond the limits of national jurisdiction. One attempt to do this is presented in the case study below describing the High Seas Gems Project.

Box 17. CASE STUDY: High Seas Gems Project

The High Seas Gems project is an initiative to highlight 10 priority sites in the high seas that were selected by scientists around the world using the newly-adopted CBD criteria (concentrated abundance or diversity, rarity, naturalness, or vulnerability, as well as feeding and breeding grounds of migratory species). The sites include the Ross Sea in the Southern Ocean, the Emperor Seamount Chain in the Pacific Ocean, the Sargasso Sea and Charlie-Gibbs Fracture Zone in the Atlantic Ocean, the Saya de Malha Banks in the Indian Ocean, Gakkel Ridge in the Arctic Ocean, the Southeast Shoal of the Grand Banks, the Pelagos Sanctuary for Mediterranean Marine Mammals, East Pacific Rise Hydrothermal vents and the Lord Howe Rise in the Southern Pacific Ocean. The 10 sites exemplify the range of habitats in the world's oceans, and house an immense amount of biological diversity, much of which remains poorly described or even undiscovered. The project is a collaboration between the cosmetics company Chantecaille Beauté, IUCN, World Commission on Protected Areas (WCPA), and Marine Conservation Biology Institute (MCBI).

Source: http://www.mcbi.org/what/hsbooklet.htm and
http://cmsdata.iucn.org/downloads/high_seas_gems_booklet_final.pdf

164. Other compatible criteria for identifying areas of ecological and biological importance also exist, such as those used to identify marine Important Bird Areas (IBAs). There is considerable overlap and congruence between the CBD EBSA criteria and the IBA criteria, particularly relating to vulnerability and irreplaceability. Seabirds are oceanic top predators that are particularly easy to detect, track and count, and can act as important indicators of wider marine biodiversity and marine ecosystem health. Marine IBAs (defined on the basis of seabird data) are likely to be strong candidates for the identification of, or inclusion within, EBSAs. Specifically, quantitative data (especially from remote-tracking studies) on seabird distributions at sea can make important contributions to identifying areas that are important for annual life cycles, life history stages, migration routes and irreplaceability (rarity, global threat).

165. Further progress in regards to EBSAs was made in the context of the Expert Workshop on Scientific and Technical Guidance on the Use of Biogeographic Classification Systems and Identification of Marine Areas Beyond National Jurisdiction in Need of Protection (Ottawa, Canada, 29 September - 2 October, 2009). Key results from the workshop are described below.

Box 18. Key results from the Expert Workshop on Scientific and Technical Guidance on the use of Biogeographic Classification Systems and Identification of Marine Areas Beyond National Jurisdiction in Need of Protection

The workshop reviewed progress made in identification of areas beyond national jurisdiction that meet the criteria in Annex 1 to decision IX/20, as well as national and regional experiences of applying similar criteria. The workshop heard examples from Senegal, China, Mexico, Canada, Philippines, Brazil, France, Bulgaria, Norway, the Latin American and Caribbean Region, OSPAR, the Black Sea, and the UNEP Mediterranean Action Plan (UNEP-MAP). Relevant initiatives by international organizations, including the FAO, the International Seabed Authority (ISA), UNEP-WCMC, the Census of Marine Life (CoML), the Ocean Biogeographic Information System (OBIS), the World Commission on Protected Areas (WCPA), and Birdlife International were reviewed. There is a great deal of work underway through countries, organizations and initiatives in regards to identifying ecologically and biologically important areas, including beyond national jurisdiction in the Mediterranean, the North and Northwest Atlantic and as

Important Bird Areas in the High Seas. The scientific work undertaken as part of the Global Ocean Biodiversity Initiative (GOBI) was also described (see paragraph below this box).

Following the summary of recent progress and experiences, the workshop concluded that there are no inherent incompatibilities between the various sets of criteria that have been applied nationally and by various IGOs (FAO, IMO, ISA) and NGOs (e.g., BirdLife International and Conservation International). Consequently, most of the scientific and technical lessons learned about application of the various sets of criteria can be generalized. The workshop then developed scientific guidance on the identification of marine areas beyond national jurisdiction, which meet the scientific criteria in annex 1 to decision IX/20. This guidance was consolidated from the experience reported by Parties, IGOs, NGOs, and experts who have used these or similar criteria in the identification of EBSAs in marine ecosystems. Guidance was provided for the application of each individual criterion, and available methods and tools were reviewed. The workshop also provided advise on more general issues related to scale; relative importance/significance; spatial and temporal variability; accuracy, precision and uncertainty; and taxonomic accuracy and uncertainty. Issues related to capacity building and data and analysis for identifying EBSAs and biogeographic classification systems were also considered.

Regarding biogeographic classification systems, the workshop heard experiences about their development and uses from the global level (the Global Open Oceans and Deep Seabed (GOODS) biogeographic classification), and from Australia, Mexico, Canada, WCPA and the World Ocean Council. The workshop concluded that biogeographic classification systems are used nationally and regionally in many different management applications, ranging from assessment (both scientific and environmental impact) and monitoring to the implementation of the ecosystem approach and development of networks of marine protected areas. The workshop provided examples from each of these uses from various parts of the world. The workshop also provided guidance for the further development of biogeographic classification systems in general, and put forward specific considerations relating to the use of the GOODS biogeographic classification. In this regards, the workshop noted that while the GOODS biogeographic classification in its present format provides a reasonable basis for management, its refinement in the future with new data could make it even more useful. Guidance regarding this refinement was provided.

166. The Global Ocean Biodiversity Initiative (GOBI) is a new initiative of a growing number of partners worldwide facilitated by IUCN. GOBI is supported by the German Federal Agency for Nature Conservation (BfN) as part of the German COP presidency. GOBI aims to help countries as well as regional and global organisations use existing and new methodologies and data to identify ecologically or biologically significant marine areas (EBSAs) in need of protection beyond national jurisdiction. As an initial component of this work, GOBI has engaged the scientific community to provide scientific support and collaboration that will assist States and relevant regional and global organisations with the best available scientific data, tools and methods to identify EBSAs. GOBI is also developing practical illustrations on how the criteria can be interpreted and applied.

Operational objective 3.3: To achieve effective management of existing marine and coastal protected areas

Status and trends of MCPA management

167. Ensuring the effective management of existing marine and coastal protected areas is as important as establishing new areas. According to the 3rd National Reports, 42% of Parties reported that effective management of MCPAs has been put in place with enforcement and monitoring. 31% reported that their MCPA system is surrounded by areas where sustainable management practices are employed, and 38% indicated that their national systems include areas prohibiting extractive uses. It is not known whether this figure is substantially higher at present time. However, the general experience is that many MCPAs have difficulty meeting their objectives, due to funding shortfalls, low compliance, lack of enforcement, and other challenges.

Management plans

168. A number of countries have put in place management plans for their MCPAs or MCPA networks. Australia reports that management plans or interim management arrangements are in place for all 26 existing Commonwealth MPAs, and are supported by a strong legislative framework, which requires that the management plans provide for the protection and conservation of the MPAs and state how they will be managed. This includes providing for a comprehensive day to day management regime that protects the values of the Reserves by:

- Managing their use (through permits, rules and restrictions);
- Developing and implementing appropriate research and monitoring, natural and cultural heritage management and community education programs and frameworks;
- Establishing effective compliance and enforcement arrangements; and
- Developing performance assessment and adaptive management systems.

169. Colombia reports on the development of a management plan for the MCPA in the coral archipelago of *del Rosario y San Barnardo*. In order to enhance management, Colombia is also undertaking socio-economic monitoring in a number of MCPAs.

170. In the Wider Caribbean, efforts are under way to develop a MPA list under the Specially Protected Areas and Wildlife (SPAW) Protocol, in order to establish a regional cooperation programme for strengthening management effectiveness through the UNEP Regional Seas Programme.

Integration and stakeholder participation

171. Effective management also depends on developing strong working relationships between different levels of government involved in the management process, as well as the sectors involved in activities around the MCPA. Additionally, many countries stress the importance of consulting, communicating and closely working with stakeholders. For example, Canada has Management Plans and stakeholder advisory committees established or under development for the majority of National Marine Conservation Areas and *Oceans Act* Marine Protected Areas. Corresponding effectiveness monitoring and reporting plans are at various stages of development.

172. In the Indian context, recent amendments to the Wildlife Protection Act provide an inclusive approach to protected area management, calling for advisory committees to be set up for sanctuaries, and inclusion of communities in management of protected area categories. The Wildlife Action Plan of India lays out the various principles that are required for management, and calls for effective management through ensuring peoples' participation, and setting up participatory management committees for each

protected area, with guidelines for local community involvement in the different management zones of protected areas and adjacent areas[113].

Local and community-based management

173. One alternative to traditional government-based management systems is management by local communities. As demonstrated in the case study below relating to Locally Managed Marine Areas in the Pacific, this option can provide for culturally appropriate approaches to resource management.

Box 19. CASE STUDY: The Locally Managed Marine Areas (LMMA) Network in the Pacific

Well-designed networks of marine protected areas (MPA) are essential for coral reef conservation in many places, yet it is often challenging for practitioners and scientists to establish networks of MPAs that adequately fulfil the biodiversity conservation needs, as well as the social needs at a particular site. The Locally Managed Marine Areas (LMMA) Network is comprised of networks of LMMAs in 7 countries in the Pacific, and is based on the requirements of project commitment and participation. This is an example of a unique and practical approach that has emerged to address some of the social and political obstacles to successful MPA network initiatives.

The LMMAs cover an extensive area of the southwestern Pacific. Categories of management include community-based marine area management initiatives and collaborative management (national, NGOs, institutions and resource owners/users) of marine resources (co-management). LMMA tools include: no take areas or *tabus*, seasonal harvest and rotational harvest areas (temporary or permanent); species-specific harvest refugia, e.g., turtle/lobster moratoria; and restriction of fishing or harvesting effort.

Management approaches can be adapted to the specific circumstances of small islands. The LMMA network has grown from eight sites in 2000 to 244 in 2005. Participating countries include the Federated States of Micronesia, Fiji, Indonesia, Palau, Papua New Guinea, the Philippines and the Solomon Islands.

In Fiji, monitoring has demonstrated the real impact of the approach in economic terms (increased harvests and sustainability of marine resources). The shared vision of stakeholders underpins the success of the project, and this includes: healthy ecosystems and communities, abundant marine and fish stocks, and sustainable fisheries utilization; protected marine biodiversity; sustainable development in coastal communities; understanding of what communities are doing and can do in managing marine areas; and understanding of ecological and socio-economic responses to LMMA and coastal management implementation. Adaptive management is central, and there is a strong emphasis on gender and youth empowerment. Results for Fiji since 1997 have included: a 20-fold increase in clam density in the *tabu* areas; average of 200-300% increase in harvest in adjacent areas; tripling of fish catches; and 35-45% increase in household income.

Source: Aliferati Tawake, University of South Pacific, Fiji

Financial sustainability

174. Financial sustainability is another important component of effective management. For example, Brazil has created specific funds for financing coastal and marine protected areas from resources arising

[113] Voluntary report of the International Collective in Support of Fishworkers

from environmental compensation (projects that have some level of environmental impact resulting in compensation being paid).

Assessing management effectiveness

175. There are currently no studies assessing MCPA management effectiveness globally. Some regional and national assessments exist, and include studies of sites in the West Indian Ocean, the Mediterranean, Oceania, North America, Europe, Latin America and the Caribbean, and Asia. However, although it is generally known that MPCA management effectiveness leaves a lot to be desired, there is no comprehensive information available to document this. The most recent information from terrestrial protected areas indicates that "protected areas are performing at a barely acceptable level overall"[114]. Of the different types of management effectiveness measured, it seems that MCPAs have often been more effective in reaching biological goals than social ones, and that this failure to consider social realities has been a major cause of MCPA failure[115].

176. A number of guidelines have been developed for evaluating management effectiveness. The most commonly used include IUCN indicators for evaluating MPA management effectiveness and the World Bank score card to assess progress in achieving management effectiveness goals for MPAs. The IUCN indicators are part of a book titled "How is your MPA doing?", which offers a variety of specific biological, socio-economic and governance indicators to measure the effectiveness of management actions in achieving MPA goals and objectives. The book was developed by IUCN, WWF and the US National Oceanic and Atmospheric Administration (NOAA) in 2004, and has been used at a number of sites. In the box below, Italy reports using this tool to evaluate management effectiveness at a number of sites.

Box 20. CASE STUDY: Assessing management effectiveness of Italian marine protected areas

The Ministry of the Environment funded the initiative entitled "Tools for assessing the effectiveness of management and adaptive management for Italian Marine Protected Areas" in 2006. The objective was to provide the authorities responsible for managing Italian MPAs the tools required to assess the effectiveness of the efforts made to achieve management-related objectives. This involves a user-friendly manual entitled "How is your MPA doing?" (http://www.effectivempa.noaa.gov/guidebook/guidebook.html), which has been translated into Italian and adapted to the national context (link to download at www.mei-italia.com).

The following pilot marine areas are engaged in the initiative: Isole Ciclopi (http://www.ampciclopi.it/) - Penisola del Sinis - Isola di Mal di Ventre (http://www.areamarinasinis.it/) - Secche di Torpaterno (http://www.ampsecchetorpaterno.it/)- Torre Guaceto (http://www.riservaditorreguaceto.it/) e Miramare http://www.riservamarinamiramare.it/.

Source: 4th National Report of Italy

177. Other countries have used their own methods to evaluate management effectiveness. For example, Finland undertook an evaluation of one marine site as part of a comprehensive international

114 Leverington, F., Hockings, M. and K. Lemos Costa (2008) Management Effectiveness Evaluation in Protected Areas: A Global Study. An IUCN report.

115 Christie, P. (2004) Marine Protected Areas as Biological Successes and Social Failures in Southeast Asia. American Fisheries Society Symposium 42:155-164.

Management Effectiveness Evaluation (MEE) of the Finnish protected area system. Finland has also developed principles of protected area management. These principles include guidelines on the aims, function and management of state-owned protected areas.

Capacity building and challenges

178. Finally, capacity building and training activities have been conducted by international organizations. For example, the United Nations Division on Ocean Affairs and Law of the Sea (DOALOS) has developed a manual and training course on the Development, Implementation and Management of Marine Protected Areas, the first delivery of which was aimed at small island developing States of the Pacific region.

179. The CBD Secretariat has undertaken a number of sub-regional and regional capacity building workshops in the context of the programme of work on protected areas, which also addresses MCPAs. These workshops have strengthened capacity for (a) conducting ecological gap analysis (b) developing sustainable financing (c) using guidelines for improving / assessing management effectiveness through exchange of country experiences, case studies, available tools and resources.n

180. Within UNEP Regional Seas Programme for the Wider Caribbean (the Caribbean Environment Programme), a comprehensive capacity building programme is in place since 1999 for MPA managers and stakeholders focusing on all aspects of MPA management, training trainers, facilitating exchanges, social networking and technical assistance through small grants (http://www.cep.unep.org/about-cep/spaw/campam-network-and-forum)

181. The *"Life Web Initiative"*, which was launched at COP-9 by the German Ministry for the Environment, aims at supporting the implementation of the CBD Programme of Work on Protected Areas through enhancing partnerships at a global level. The purpose of the initiative is to match voluntary commitments for the designation of new protected areas and the improved management of existing areas with commitments for dedicated (co-) financing of these areas. Marine protected area projects supported include areas within the Coral Triangle and new MCPAs established as part of the Micronesia Challenge[116].

182. While management effectiveness is receiving increasing focus, it still presents a myriad of challenges for countries. The development of management plans, stakeholder consultation, managing environmental stressors, enforcement, and attaining financial sustainability are complex processes. Although comprehensive data is lacking, anecdotal evidence from country reports indicates that much more can still be done to improve MCPA management effectiveness.

Operational objective 3.4: To provide support for and facilitate monitoring of national and regional systems of marine and coastal protected areas

National monitoring programmes

183. A monitoring programme is an important component of adaptive management, and thus increases the management effectiveness of MCPAs. Several countries report that they are undertaking various monitoring activities as well as targeted research aimed at assisting MCPA management.

184. In Australia, research and monitoring programs are currently in place in all Commonwealth Marine Reserves under Reserve Management Plans. These programs provide information on the key conservation attributes of each reserve and provide a mechanism to monitor the status of reserve biodiversity. Management Plans include a performance assessment regime to evaluate how well

116 http://www.cbd.int/lifeweb/

management strategies have worked in the past and how best to improve management practices across the Commonwealth marine estate in the future. Management Plans are reviewed before expiry to assess management effectiveness, and to inform the development of new plans. All results are made publicly available on the internet.

185. In Italy, the Ministry of the Environment, Land and Sea mandates the undertaking of regular monitoring of the environmental and socio-economic conditions of MCPAs. Each agency managing a MCPA is required to inspect it and prepare an annual report. On the basis of the data acquired through the monitoring programme, an analysis of possible threats is to be conducted and the MCPAs brought up to speed to optimize their environmental and socio-economic management with the aim of pursuing sustainable development.

Scientific research to support management

186. Many MCPAs support a wide variety of scientific research activities aimed at improving management. For example, larval dispersal and its importance for the design of marine reserve networks are studied in Sweden. This research programme will develop tools for the analysis of connectivity among marine areas, using a combination of hydrographic models and mathematical network analysis. The aim of the project is to produce generic methods that can be applied in any network, and specifically to evaluate existing MPA networks in Sweden.

187. The Department of Fisheries and Oceans in Canada has created CHONe, a strategic partnership between universities and government to address a need for scientific criteria for conservation and sustainable use of marine biodiversity. CAHR, established in 2008, is a virtual centre with participation from Science and Habitat Management in all Canadian regions to address habitat issues in support of the Department's mandate to conserve and protect fish habitat.

188. Some MCPAs undertake activities related to ecosystem restoration, as is the case in Portugal, as part of the BIOMARES project. This project was created to conserve and recover the biodiversity of MCPAs, and will include activities related to establishment of environmentally sound anchorages, recovery of seagrass meadows, habitat mapping and public awareness.

189. Climate change poses new threats to MCPA managers and challenges them to develop appropriate responses at multiple scales. At the broadest scale is the establishment of MCPA networks that are designed to be resilient in the face of change. A number of MCPA networks have included climate change resilience principles in their design, including those in Palau, the Mesoamerican Reef, Quintana Roo, Mexico, Grenada and sites in Indonesia.

190. The importance of providing scientific information in a format that is useful for management is highlighted by an example from PEMSEA. Prior to 1994, the six major institutions mandated to perform marine environmental monitoring in East Asia conducted these activities in a disparate, uncoordinated manner. As a result, a tremendous amount of data failed to be effectively utilized and no conscious effort was made to use these data as feedback into management and policy decision making. The data, rather, usually ended up in the form of scientific reports that were unused by coastal managements and policymakers. This situation changed with the creation of a marine monitoring network, a major element of integrated coastal management activities planned under PEMSEA. Various tasks were allocated among the institutions based on the comparative advantage of each. This measure proved cost-effective and optimized monitoring efforts. Resources were shared, and methods, standards and results were exchanged. More importantly, the monitoring procedures were standardized, allowing monitoring data to

be managed, processed and translated according to management and policy needs. The resulting data are now being used to facilitate immediate action, or to refine environmental management plans[117].

191. A similar effort towards regional collaboration in marine biodiversity-related research has been initiated in the Black Sea. A Black Sea Network for Marine Biodiversity Centres has been organized to facilitate new directions in marine biodiversity research, and to address knowledge gaps[118].

Operational objective 3.5: To facilitate research and monitoring activities that reflect identified global knowledge gaps and priority information needs of management of marine and coastal protected areas

International and regional initiatives

192. Research and monitoring responding to global knowledge gaps and priority information needs is often conducted through large multi-country initiatives. While many of them may not be specifically focused on the creation or management of marine protected areas, they are aimed at filling scientific information needs that will assist in the subsequent establishment and management of MCPAs. Examples of such initiatives include the Census of Marine Life, the Global Coral Reef Monitoring Network (GCRMN), the GEF-World Bank Coral Reef Targeted Research and Capacity Building for Management (CRTR) Programme and the CRISP project, which are described in more detail in section 3 of this document. It should be noted that the CRISP project has assisted in establishing 30 MCPAs in 12 different countries.

193. The Global Forum on Oceans, Coasts and Islands has undertaken targeted policy-related research to support the CBD programme of work on marine and coastal biological diversity, and to assess the degree of implementation of the marine-related targets in the Johannesburg Plan of Implementation. A policy brief on Marine Biodiversity and Networks of Marine Protected Areas was prepared for the 4th Global Conference on Oceans, Coasts and Islands in 2008 (Hanoi, Vietnam, April 7-11 2008)[119]. This brief has provided information for the preparation of the present review document.

194. On a regional level, the CORDIO (Coastal Oceans Research and Development in the Indian Ocean) network undertakes research, monitoring and capacity-building for sustainable use and protection of marine environments. The work of CORDIO includes the assessment of vulnerability and adaptation of ecosystems and dependent communities, with a strong focus on climate change.

195. The concept of building resilience principles into MCPA management is relatively new and still undergoing research. Until recently, resilience had never been explicitly defined or listed as a criterion for MPA selection or design. Yet the concept of resilience demonstrates that there are positive actions can be taken to counter potentially devastating impacts of climate-related bleaching. The Nature Conservancy (www.reefresilience.org) has created a reef resilience toolkit, which provides coral reef managers with guidance on building resilience to climate change into the design of MCPAs and daily management activities.

117 Chua, Thia-Eng (2006) The Dynamics of Integrated Coastal Management: Practical Applications in the Sustainable Coastal Development in East Asia. 468p. Global Environment Facility/United Nations Development Programme/International Maritime Organization Regional Programme on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), Quezon, City, Philippines

118 Bulgaria's voluntary report on the implementation of the programme of work on marine and coastal biodiversity

119 http://www.globaloceans.org/globalconferences/2008/index.html

Conclusions

196. This chapter demonstrates that there are numerous activities undertaken by countries individually or collectively to establish MCPAs and networks. While the area covered by MCPAs is increasing, it is still not enough to reach the 10% target set by CBD. In addition, the global MCPA network is not yet representative, comprehensive, adequate or effectively managed. Particularly under-represented are ecosystems further away from shore, in national EEZs and beyond. Open ocean habitats are also extremely under-protected. Climate change will present additional challenges to MCPA managers, but the establishment of additional MCPAs may be one of the best ways to increase the resilience of vulnerable ecosystems.

Programme element 4: Mariculture

Operational objective 4.1: To promote use of techniques, which minimize adverse impact of mariculture on marine and coastal biological diversity

Status and trends in mariculture and aquaculture

197. According to the FAO State of World Fisheries and Aquaculture (SOFIA) 2008, world aquaculture has grown dramatically in the last 50 years. From a production of less than 1 million tonnes in the early 1950s, production in 2006 was reported to have risen to 51.7 million tonnes, with a value of US$78.8 billion. This means that aquaculture continues to grow more rapidly than other animal food-producing sectors. While capture fisheries production stopped growing in around mid-1980, the aquaculture sector has maintained an average annual growth rate of 8.7 percent worldwide (excluding China, 6.5 percent) since 1970. Annual growth rates in world aquaculture production between 2004 and 2006 were 6.1 percent in volume terms and 11.0 percent in value terms.

198. Most aquaculture production of fish, crustaceans and molluscs continues to come from inland waters (61 percent by quantity and 53 percent by value). Aquaculture in the marine environment contributes 34 percent of production and 36 percent of total value. While much marine production is high-value finfish, production in this environment also consists of a large amount of relatively low-priced mussels and oysters.

199. Most cultured marine species are of relatively high commercial value, sometimes because wild stocks are small or declining. While the overall share of farmed fish in marine finfish production has stayed quite low, for the species that are farmed, aquaculture frequently dominates the market. This is the case for species such as the Japanese seabass, gilthead seabream, red drum and bastard halibut. In fact, for species such as these, the amounts now produced by aquaculture are often substantially higher than the past highest catch recorded by capture fisheries.

200. World aquaculture is heavily dominated by the Asia–Pacific region, which accounts for 89 percent of production in terms of quantity and 77 percent in terms of value. Of the world total, China is reported to produce 67 percent of the total quantity and 49 percent of the total value of aquaculture production. The Asia–Pacific region accounts for 98 percent of carp, 95 percent of oyster production, and 88 percent of shrimps and prawns (penaeids). Norway and Chile are the world's two leading producers of cultured salmons (salmonids), accounting for 33 and 31 percent, respectively, of world production. In Latin America and the Caribbean, in the last decade, salmonids have overtaken shrimp as the top aquaculture species group as a result of outbreaks of disease in major shrimp-producing areas and the rapid growth in salmon production in Chile. Atlantic and Pacific salmon dominate in Canada. Aquatic plant production by aquaculture in 2006 was 15.1 million tones.

201. In the CBD national reports, many countries indicate that their national mariculture developments are still in their infancy. For example, compared with fishing, aquaculture is currently of little commercial

significance to the Pacific Islands, with one important exception, black pearl farming, which is virtually confined to eastern Polynesia. Elsewhere in the Pacific, considerable development is needed before aquaculture can be considered economically sustainable. Similarly, many countries from Eastern Europe, small islands in the Caribbean, and many African countries report that mariculture is not yet developed at any great scale.

202. Growth rates for aquaculture production are slowing, partly owing to public concerns about aquaculture practices and fish quality. Genetically modified organisms (GMOs) remain a controversial issue. In response to these concerns, integrated multitrophic aquaculture (which promotes economic and environmental sustainability) and organic aquaculture are on the rise.

Development of national policies and legislation

203. Many countries, both developed and developing, have enacted (or are in the process of drafting) national aquaculture legislations and regulations that govern the licensing, monitoring and control of aquaculture. These legal instruments ensure that any development of the industry is founded on sustainable ventures, is appropriately located, and is carried on in accordance with high standards of environmental and ecological protection. Most laws and regulations cover several aspects of the supply side of aquaculture, including planning and access, water and wastewater, seed, feed, aquaculture investment, and fish movement and disease control.

204. In Norway, the Aquaculture Act contains clear guidelines for adapting aquaculture to the environment. The activities of commercial enterprises must, through their entire lifetime, be environmentally justifiable. This implies that an aquaculture operation must not at any time have appreciable negative consequences for the surrounding environment and wild organisms[120].

205. In other countries, aquaculture and/or mariculture are regulated under fisheries or other relevant legislation. For example, in China, the Fisheries Law seeks to enhance - *inter alia* - the production, increase, development and reasonable utilization of the nation's fishery resources. It requires the state to adopt a policy that calls for simultaneous development of aquaculture, fishing and processing, with special emphasis on aquaculture. The Law is implemented by the Regulation for the Implementation of the Fisheries Law[121].

206. In their national and voluntary reports, some countries report on the development and adoption of overarching policies for marine aquaculture. These include the Strategy for Sustainable Development of European Aquaculture, which takes an approach where farming technologies, socio-economics, natural resources use and governance are integrated. A similar approach is taken by Chile's National Aquaculture Policy[122].

207. Canada has in place a Program for Sustainable Aquaculture, which aims to increase scientific knowledge to support decision-making, strengthen measures to protect human health, and make the federal legislative and regulatory framework more responsive to public and industry needs. Canada has also established a set of principles, as part of the Aquaculture Policy Framework, to guide its decision-making and ensure that actions support the social, economic, and environmental aspects of sustainable aquaculture development.

208. Brazil has undertaken an Impacts of Mariculture Study, which was executed by the Foundation University of Rio with the purpose of assessing impacts caused by mariculture on biodiversity and water

120 Norway's 4th National Report

121 FAO National Aquaculture Fact Sheets: http://www.fao.org/fishery/legalframework/nalo_china/en

122 http://www.subpesca.cl/docs_ingles/PNA_English.pdf

quality. The objective of the study was to provide support for public policies regulating the activity, and to allow the selection of areas along the Brazilian coast which are more appropriate for this activity.

Environmental Impact Assessment and permitting

209. In their 3rd National Reports, 64.71% of all responding parties indicated that they apply environmental impact assessments to mariculture developments. In some countries, environmental impact assessments are required for all mariculture developments, while in others they are only required for developments of a certain size or intensity. In most cases the requirement for an EIA is enshrined in law. For example, in the small island of Vanuatu, EIAs are mandatory since the introduction of the Environment Management and Conservation Act (2003). European countries follow the EC Environmental Impact Assessment Directive, which stipulates that "intensive fish farming" requires an EIA. However, the obligation to perform an EIA depends on screening of the individual case and/or whether national thresholds are reached or exceeded. The same Directive requires an EIA for farming more than 100 tonnes of salmon and trout. In the United Kingdom, EIAs are required for all activities which discharge or deposit into the marine environment. Outside of Europe, Malaysia has implemented a requirement for an EIA for land-based aquaculture development in mangrove areas. In Australia, The potential environmental impacts of offshore aquaculture projects are outlined in the policy document Offshore Aquaculture, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which provides guidance to proponents of potential aquaculture projects on the possible environmental impacts and the assessments and approval regulations under the EPBC Act.

210. In many countries the establishment of new mariculture operations requires the proponent to go through a permitting or a licensing process, which includes the consideration of environmental impacts. For example, the box below highlights the process used by the Scottish Environment Protection Agency (SEPA).

Box 21. CASE STUDY: Marine aquaculture in Scotland

In Scotland marine aquaculture is dominated by the production of salmon. Salmon farming, in common with the production of all marine fish species, takes place almost entirely in floating net cages. The fish are fed with specially formulated pelletized diets, of which a small proportion along with faeces from the fish, are released from the cages and into the water column, to be deposited on the seabed. These discharges of waste feed and faeces, along with residues of medicines used to treat the fish when they suffer from diseases or parasite infestations, may pose a risk to the environment.

In common with any industry which makes discharges to the aquatic environment, operators wishing to establish a fish farm in the sea around Scotland must apply for and be granted a licence under the Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR). These regulations provide SEPA with powers to ensure that activities which may pose a risk to the water environment are controlled. SEPA makes sure this is the case by setting limits on the amount of fish that can be held in the cages and thus the amount of food used. SEPA also protects the environment by limiting the amount of certain medicines that can be administered and discharged. In setting these limits, SEPA aims to ensure that the fish farm is operating within the capacity of the environment or in some sense is in harmony with the sea in the location in which it is sited.

The process of determining what the appropriate size of the farm is for a given location is quite complex. Prior to submitting an application, operators are recommended to discuss their proposals with SEPA. This pre-application consultation can avoid potentially costly difficulties and disappointment should SEPA determine that the proposals are inappropriate for the site concerned. SEPA offers the opportunity for pre-consultation without prejudicing the formal application process.

The process of applying for a CAR licence involves a number of steps and includes an advertising and consultation process. Applicants must also submit information on the physical, chemical and biological condition of the seabed. They must also measure the currents in the area and conduct computer modelling simulations showing how waste will be dispersed from the site.

Following submission and advertising of the application, SEPA will consider the proposals and either grant or refuse a licence. Where a licence is granted and a farm is developed, SEPA will undertake monitoring and inspections of the farm and the operator will also be required to commission regular studies of the impact of the farm on the seabed. SEPA recovers part of the cost of this monitoring regime through the levying of charges. Fish farmers also make data returns to SEPA detailing the scale of the discharges from each of their farm premises. This data forms a large part of the publically available.

Source: SEPA at http://www.sepa.org.uk/water/aquaculture/marine_aquaculture.aspx

Effective site selection

211. Another effective technique for avoiding the adverse impacts of mariculture on biodiversity is the use of effective site-selection methods in the framework of integrated marine and coastal area management (IMCAM). A number of countries are now considering mariculture and other uses of the marine and coastal environment holistically as part of their efforts to implement IMCAM. The results of the 3rd National Reports show that 46.08% of all parties were applying these types of site selection methods. Regionally, the reports indicate that 36% of countries in Africa, 46.43% of countries in Asia and the Pacific, 27.27% of countries in Central and Eastern Europe, 47.37% of countries in Latin America and

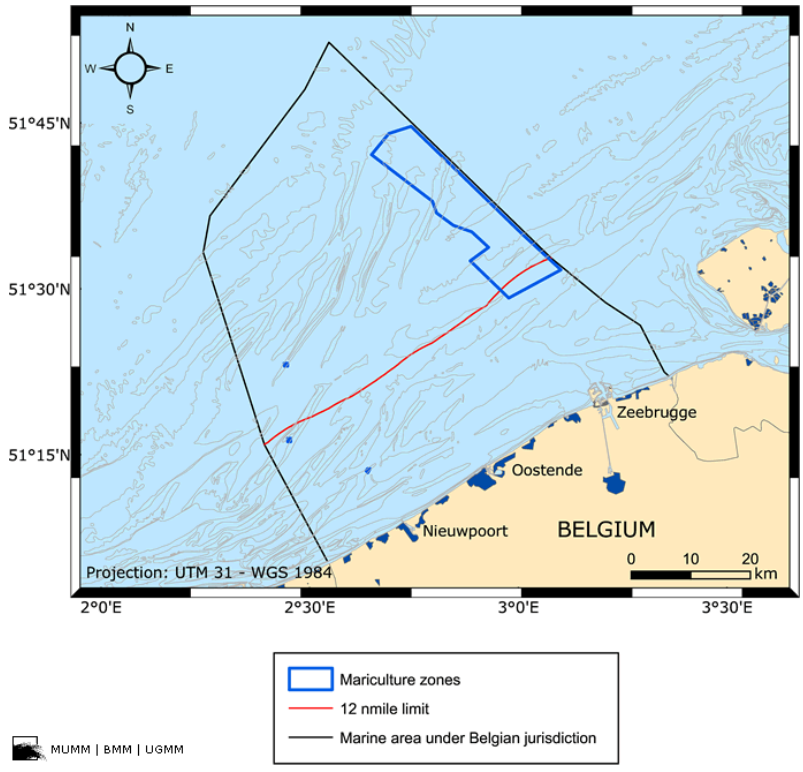
the Caribbean and 68.42% of countries in Western Europe and Others have developed and applied effective site selection methods in the framework of integrated marine and coastal area management.

212. According to the FAO, many countries have developed regimes where aquaculture can only take place in designated zones, and any person wishing to engage in aquaculture must first apply for and obtain an aquaculture license. In many instances, unlicensed operations can entail a fine, imprisonment or the destruction of the operation – or any combination of the three penalties. In some countries, there are also species-specific zones, and certain species can only be farmed in particular zones. The challenge for many governments would be to license or register existing farms, in particular large numbers of small operations, which may not even qualify as an aquaculture operation. Although small in size, collectively they account for large areas of land that could continue to affect sustainability.

213. Although quantitative data is not available, the information provided by countries in the voluntary thematic reports on marine and coastal biodiversity indicate that there is an increasing trend towards systematic spatial planning of all uses of the marine and coastal environment, including mariculture. Spatial planning that takes into account mariculture has been implemented, *inter alia*, in many European countries and in China. The box below highlights an example from the Belgian coast, where space for mariculture operations is allocated in the context of IMCAM.

Box 22. CASE STUDY: Implementation of mussel mariculture in Belgium

While there was no mariculture activity reported by Belgium in the 3rd National Report (in 2005), shortly thereafter a permit was requested for the production of bivalve mollusks (mussels) in 4 different North Sea areas. The Management Unit of the North Sea Mathematical Models (MUMM) carried out the impact assessment study for the proposed activity. This resulted in an advice containing proposals for a series of conditions, the establishment of an environmental monitoring program and suggestions for the content of the annual activity report. The figure below shows the four North Sea areas where the production of bivalve mollusks is permitted.



The following measures were instated in order to protect the marine environment:

- In case of damage to the ecosystem, to rare and endangered species or other natural resources, to protected areas, or to human health, the licensee will restore the site in its original state.
- The licensee needs to draw up an emergency plan.
- Sunken structures or components need to be removed by the licensee.
- No medication, nor any additional food sources, will be added.
- The licensee is obliged to report the occurrence of exotic species and the infection with parasites and diseases.

The license only permits the cultivation of mollusks, by the installation of artificial structures, and starting from seedlings naturally occurring in the North Sea.

The mariculture activities are zoned in the context of other activities occurring in the Belgian EEZ, in the context of marine spatial planning.

Source: Voluntary report of Belgium on the implementation of the programme of work on marine and coastal biodiversity

214. Another example from Xiamen, China (see box below) shows how a sea-use zoning scheme was implemented in the context of IMCAM. By relocating mariculture operations, the zoning scheme managed to alleviate both pollution and user conflicts.

BOX 23. CASE STUDY: Sea-use zoning and mariculture in Xiamen, China

Xiamen is a coastal city on China's southeastern coast. Xiamen's sea-use zoning scheme was adopted in 1997, with Xiamen's coastal waters divided into three manor zones: harbour zone, tourism zone and fishing zone. These were further divided into sub-zones: shipping/port, tourism, aquaculture, coastal industries, ocean construction, mining, nature reserve, special function, and rehabilitation. One of the issues addressed by the scheme was the need to ease resource-use conflicts and stem the pollution resulting from intensive aquaculture practices. A previous policy in support of mariculture had promoted tremendous proliferation of fish cages in practically all of Xiamen's waters, resulting in pollution and use conflicts. To ease the situation, a decision was made to relocate fish farms in the East Sea (designated as a tourism zone) and the West Sea (a shipping zone). In the case of the West Sea, the implementation of relocation to Tong'an Bay was spread out over a 3-year period. Compensation was allocated to affected families through a compensation scheme that includes tax relief for the purchase of properties and assistance to fish farmers who opted to change job. In addition, permit and user-fee schemes have been implemented. The result has been a reduction in both pollution and user conflict. The zoning scheme is revised every 5 years to accommodate future developments and other socio-economic realities.

Source: Chua, Thia-Eng (2006) The Dynamics of Integrated Coastal Management: Practical Applications in the Sustainable Coastal Development in East Asia. 468p. Global Environment Facility/United Nations Development Programme/International Maritime Organization Regional Programme on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), Quezon, City, Philippines

Restoration of degraded areas

215. In East Asia, shrimp and fish aquaculture production has come at the expense of the mangroves, as mangrove areas were converted to ponds. This practice was particularly prevalent in the 1980's during the expansion of intensive shrimp farming, when large mangrove areas were cleared. The environmental impact of the shrimp farming industry has improved since, and the FAO has developed and adopted in 2006 International Principles for Responsible Shrimp Farming. In addition, recent efforts to replant and restore mangrove areas have been initiated in many countries. The case study in the box below describes such efforts in Thailand.

Box 24. CASE STUDY: Mangrove replanting in abandoned shrimp ponds in Thailand

Mangrove areas around Ban Pak Nam Pak Phaya in Ta Sak Sub-district of Mueang District in Southern Thailand were converted to shrimp ponds during the height of the shrimp farming industry in the 80s and early 90s, most of which are now being abandoned due to rising production costs and declining demand for the commodity. Mangroves occur as a thin belt of less than 10 m in width along the small rivers that drain this area. Tidal circulation in these areas does not occur uninterrupted due to the presence of sluice gates of the abandoned shrimp ponds.

Although statistics are not available, substantial extent of inter-tidal land exists as abandoned shrimp ponds. The "Green Carpet" project, supported by KEIDANREN Conservation Fund (KNCF) and Japan Fund for Environmental Conservation (JEC) in collaboration with the Thai Union for Mangrove Rehabilitation and Conservation has planned to replant about 1000 ha of abandoned shrimp ponds within 5 years. The mangrove species *Rhizophora mucronata, Rhizophora apiculata, Ceriops tagal* and *Bruguira cylindrical* have been used in the plantations and the former two species have shown the best growth rate and 75-90% survival rate. Also they have shown that general soil conditions have improved over a period of three years after planting.

Adapted from case study by Mala D. Amarasinghe, Varunthat Dulyapurk, Wara Taparhudee, Ruangvit Yoonpundh and Sirisuda Jumnongsong at Network of Aquculture Centers in Asia Pacific http://www.enaca.org/modules/news/article.php?storyid=1822

Controlling effluents and waste

216. Effluent and waste resulting from mariculture operations is another source of potential impact on biodiversity. According to the FAO, many countries have laws and regulations on water access and use, and wastes. In most countries, the right to put up any structure in open water areas, such as fish traps and fish cages, or to dam flowing water for exclusive private use, requires a permit from the designated authority. However, such laws are often difficult to enforce because it is not always possible to monitor these activities.

217. In developed countries and in many developing countries where aquaculture is important, the governing authority generally defines effluent guidelines or standards for aquaculture wastewater discharges. In most cases, these are based not on risks or impacts upon receiving waters but on the performance of the technologies used for the treatment and control of the wastes. In many cases, the standards have been adopted from other countries. Aquaculture operations that intend to discharge wastewater must obtain a permit before initiating a discharge. The permit specifies the conditions and effluent limitations under which the operation may make a discharge, and it establishes pollutant monitoring and reporting requirements.

218. According to the CBD 3rd National Reports, 45% of all Parties had developed effective methods for effluent and waste control. Some examples of national initiatives include the new National Water Protection Policy approved by the Finnish Government in 2006. This policy defines measures needed to achieve good water quality by 2015, and aims to further reduce nutrient loads from fish farms through controls on the location of the fish farms, improved feeding methods, and intensified waste protection measures. New environmental objectives will be defined jointly with the fish farming industry on a voluntary basis, and will complement existing policy instruments.

219. Canada undertakes ongoing monitoring and assessment of wild and aquaculture shellfish growing areas through its Marine Water Quality Monitoring Program. Included are bacteriological assessments in the overlying water, and identifying and evaluating point and non-point pollution sources impacting on these areas.

220. Germany reports using closed containment or closed-circulation systems for mariculture, thus controlling wastewater and waste.

Genetic resources management

221. The potential genetic effects of aquaculture activities have aroused a great deal of concern among scientists and the general public. The perceived risks are often associated with interbreeding with natural populations and the adverse effects of ecosystem interactions. According to the CBD 3rd National Reports, only 28.43% of all parties have developed genetic resource management plans at the hatchery level and in the breeding areas, making this one the least implemented strategy for reducing impacts of mariculture.

222. According to a FAO review of the status and needs on aquatic genetic resources for food and agriculture, a transition to more responsible, sustainable and productive aquaculture and capture fisheries will depend in large measure upon effective management of fish genetic resources. This management is being constrained by the lack of effective policies, and has resulted largely from under-recognition of the importance of fish genetic resources for fish supply[123].

223. Additional information from the FAO indicates that many countries have legal provisions on the movement of fish (including broodstock and seed). In such countries, any introduction or import of eggs, fry, fingerlings or broodstock must be subjected to quarantine for evaluation and decision. There are also export regulations. The aim is to protect and maintain aquatic biosecurity and, in particular, to limit the spread of diseases within and beyond national boundaries. Some countries have established domestication and broodstock development and management programmes for some commercial species. This trend is continuing with significant success. However, because of the high costs of monitoring and enforcing the law, there are still many places in developing countries where aquatic animals move freely, without any inspection or certification.

224. In Chile, the cultivation and import of genetically modified living aquatic resources is now subject by law to the prior authorization of the Sub-Secretariat for Fisheries. A sanitary study is required, which must include an environmental impact assessment. The procedures will be defined by a decree of the Minister of Economy[124].

123 FAO (2007) The World's Aquatic Genetic Resources: Status and Needs. Background document CGRFA-11/07/15.2 for the Eleventh Regular Session of the Commission on Genetic Resources for Food and Agriculture. ftp://ftp.fao.org/ag/cgrfa/cgrfa11/r11w152e.pdf

124 FAO Fisheries and Aquaculture Department, National Aquaculture Legislation Overview: http://www.fao.org/fishery/legalframework/nalo_chile

225. Both Norway and France are actively undertaking research on genetic resources management. In France, this includes modelling and risk analysis studies to assess the potential genetic impact of escapees on wild populations, measures to ensure reproductive isolation between wild and domesticated stocks, and the use of sterile individuals.

226. The use of native species in aquaculture places less risk on genetic contamination. While many countries report using only native species, some mariculture operations rely on exotic species. For example, Atlantic salmon is commonly farmed in the Pacific. Chile reports that farmed resources are varied and primarily involve exotic species, especially salmonids, which are expected to continue, for many years to come, to be the most important activity in Chilean aquaculture. Safeguards are put in place to prevent escapees. It should be noted that Atlantic salmon is commonly used for mariculture in the Pacific in many areas, including Canada. Germany reports that a certificate of origin is required for imported animals used in mariculture of Pacific oyster. This certificate declares the oysters to be free of diseases and parasites. As mariculture in Germany takes place using closed containment systems, escapes and release of seed into nature is unlikely.

Avoiding/minimizing impacts of seed collection from nature and improving seed management

227. According to the CBD 3rd National Reports, 32.35% of all parties have developed controlled hatchery and genetically sound reproduction methods in order to avoid seed collection from nature. Very little information exist in the national reports regarding seed collection or management, with a couple of exceptions. In Gambia, spat collection in oyster culture was done using artificial substrates to avoid cutting/chopping off mangrove roots, which are the natural substrate of oysters, and thus minimizing environmental impact. Brazil provides the example of a small mariculture project aimed at repopulation of a native species (see box below).

Box 25. CASE STUDY: Molluscan repopulation in Brazil

An example of seed management is provided by the Marine Repopulation Project of the Ilha Grande Bay in Brazil. The project develops mariculture with the cultivation and spawning of Coquille Saint-Jacques (native mollusk of the Brazilian coast), and maintains the only laboratory in Brazil which produces coquille seeds, in addition to seeds of other mollusk species. The laboratory for seed production was built with funds from Petrobrás, who supports the program since 2000. There are two farms in Angra dos Reis and Parati, where the mollusks are fattened, and where they are protected from predatory fishing and attract crustaceans and fish, among others. The reproduction of seeds is directed at local repopulation and as provision for the mariculturers of the region. In addition to propitiate the reappearance of coquilles in the region, the project also noted the renewed reproduction of other species. A large quantity of coquilles seeds are regularly produced (5 million units in 2004, 10 million units predicted for 2005).

Source: Brazil's 3dr National Report

Preventing escapees

228. One of the greatest environmental challenges of the fish farming industry is the escape of farmed fish. Often these fish are not native to the area where they are farmed. Atlantic salmon, for example, are now found in Australia, New Zealand, Chile and the west coast of Canada and USA[125]. Particular

[125] IUCN (2009) Marine Menace – Alien invasive species in the marine environment. http://cmsdata.iucn.org/downloads/marine_menace_en_1.pdf

consideration has been given to genetic impact, due to the fact that the escapees may be spawning with wild fish species, and that they may contribute to the spreading of parasites and diseases. Mariculture can also be a source of invasive alien species, due to escapees or to the transport of species, such as oysters.

229. The Norwegian directorate of Fisheries has implemented "Vision No Escapees", a 30-point action plan from the Directorate of Fisheries to dramatically cut the number of escapees126. In 2006, the year the Government first instituted its plan, escaped trout and salmon totalled 935,000 fish – but by 2007, that number had dropped to 404,000. Numbers from the first quarter of 2008 also show a dramatic drop in escapees as compared to the same period in 2007127. Other measures to control escapees include technical requirements, such as technical standards for floating fish farms and certification of both new and existing installations.

230. While the vast majority of marine finfish production takes place in open net cages, closed containment systems are a new technology, which shows promise as a method for not only preventing escapees, but also controlling the release of effluents into the environment. While still in its early stages of development, examples of successful use of closed containment systems exist for growing finfish, seaweeds, shellfish, crustaceans and other invertebrates128.

231. In addition, many aquaculture industry associations have codes of practice for their particular operations that cover the release of mariculture species into the wild129.

126 Fiskeridirektoratet Norge http://www.fiskeridir.no/fiskeridir/english/aquaculture-management/vision-no-escapees-action-plan-from-the-directorate-of-fisheries

127 Nortrade.com at http://www.nortrade.com/index.php?cmd=show_article&id=297

128 Ecoplan International (2008) Global Assessment of Closed System Aquaculture. Prepared for the David Suzuki Foundation and the Georgia Straight Alliance on behalf of the Coastal Alliance for Aquaculture Reform

129 3rd National Report of Australia

Box 26. CASE STUDY: Salmon aquaculture

Salmon aquaculture has created controversy in many locations due to a number of threats, which include sea lice and diseases from farmed salmon potentially impacting wild stocks; escaped farmed salmon potentially threatening native fish; and pollution and drugs, such as antibiotics, being released into the surrounding waters. For example, the Alaskan Department of Fish and Game now considers wild Atlantic salmon released accidentally or deliberately from farming operations as a serious threat to native Pacific salmon species[130]. In addition, the farming of carnivorous fish is considered a net loss, as the fish are fed fish, thus depleting other fish species on a global scale.

While there are now management techniques (such as the Norwegian "Vision No Escapees" described above and close containment systems) that can be used to prevent escapees and minimize or even eliminate the release of effluents, research is still ongoing to find alternative feeds that will reduce the wild protein requirements of farmed salmon. The Norwegian National Institute of Nutrition and Seafood Research (NIFES) believes that the protein requirements of farmed salmon can be met by increasing the use of vegetable sources of protein without negative effects on the quality of the farmed salmon. Recent studies have found that salmon can grow satisfactorily with food that contains high (80%) levels of plant protein, but that the growth is still less than would be achieved using fish-based food sources. Further research is ongoing.

Further information can be found at the NIFES website at http://www.nifes.no/index.php?page_id=126&lang_id=2

Considering traditional knowledge in mariculture

232. A relatively small number of Parties are considering traditional knowledge in the context of mariculture operations. According to the 3rd National Reports, 32.35% of all parties have considered traditional knowledge, where applicable, as a source to develop sustainable mariculture techniques. Some examples do exist, however, as detailed below.

233. The Coast of Bays Corporation in Newfoundland, Canada, is responsible for the economic development of Newfoundland's south coast, and develops its plans in consultation with local communities. The Corporation's board of directors includes representatives from stakeholders such as the fishing industry, aquaculture, tourism and various community groups. The Corporation began developing a Community-Based Coastal Resource Inventory in 1997/98, in partnership with the DFO. This inventory consists of Traditional Ecological Knowledge (TEK) from coastal residents, fishers, members of environmental and recreational groups, SCUBA divers and other people who have an interest in Newfoundland's coasts. The information covers a range of subjects from lobster fisheries and aquaculture to lighthouses, shipwrecks and shorelines.

234. In Australia, traditional eel aquaculture systems of the Maar people are used as a basis for contemporary sustainable mariculture techniques. The Maar people had traditionally a sophisticated system for aquaculture and eel farming, including building stone dams to hold water, creating ponds and wetlands for growing short-finned eels and other fish, and creating channels for linking wetlands. These channels contained weirs with large woven baskets made by women to harvest mature eels. The communities maintain strong cultural affiliations with the eels today and continue to harvest eels for consumption by families. Deen Maar was declared an Indigenous Protected Area in November 1999 and a management plan for the area, the Kooyang Sea Country Plan, was recently developed. According to the plan, the Aboriginal people of South-west Victoria have a leading role in all aspects of eel management,

130 IUCN (2009) Marine Menace – Alien invasive species in the marine environment. http://cmsdata.iucn.org/downloads/marine_menace_en_1.pdf

commercial use, research and aquaculture and there are plans to examine the means for establishing regional structures to develop Indigenous fishing and aquaculture strategies.

235. Another sustainable traditional mariculture technique is silvofisheries, which is practiced in a number of countries around the world, including in Indonesia, Hong Kong, Thailand, Vietnam, Philippines, Kenya and Jamaica. Silvofisheries is a form of integrated mangrove tree culture with brackish water aquaculture. It is a type of low- input, sustainable aquaculture. This integrated approach to conservation and utilization of the mangrove resource maintains a relatively high level of integrity in the mangrove area while capitalizing on the economic benefits of brackish water aquaculture[131].

236. *Empang Parit*, the Indonesian form of silvofisheries, is the traditional application of this integrated aquaculture in the mangrove area. An *Empang Parit* model represents the greatest level of reforestation or maintenance of existing forest to pond area. It essentially consists of a mangrove-planted raised central pond bottom (80 per cent of total pond area) that alternates between being flooded and exposed as the water of the pond is raised or lowered. This raised pond bottom that is surrounded by a canal that runs adjacent and parallel to the pond dikes. Fish, shrimp, and crabs are cultured extensively in the canal.

237. Silvofishery is a labour-intensive technology appropriate for an individual or family operation and can be a viable alternative to brackish water pond culture. It diversifies products from the land and aquatic production within an environmentally benign framework and is integrated into the mangrove forest ecosystem.

Conclusions

238. While most countries seem to have legal provisions and policy frameworks in place for sustainable aquaculture development, enforcement of laws and adherence to policies is still an issue in many cases. There are often limited financial and human resources with which to monitor and enforce regulations, and this is a particular problem for countries with large numbers of small-scale farmers.

239. The most commonly implemented techniques include environmental impact assessment and site selection, and these techniques are also likely to have the greatest success in preventing or reducing negative impacts on biodiversity. Minimizing the release of effluents into the environment and the prevention of escapees are also receiving attention. The issue of genetic resources management still requires further work and research.

Programme element 5: Invasive alien species

Operational objective 5.1: To achieve better understanding of the pathways and the causes of the introduction of alien species and the impact of such introductions on biological diversity.

Pathways and causes of introduction of invasive alien species

240. According to the International Maritime Organisation (IMO), the problem of invasive species is largely due to the expanded trade and traffic volume over the last few decades. The effects in many areas of the world have been devastating. Quantitative data show that the rate of bio-invasions is continuing to increase at an alarming rate, in many cases exponentially, and new areas are being invaded all the time. Volumes of seaborne trade continue overall to increase and the problem may not yet have reached its peak[132]. According to the Global Invasive Species Programme (GISP), marine invasive species have now

[131] Alfredo Quarto: Sustainable use of the mangrove. Tiempo Cyberlibrary. http://www.tiempocyberclimate.org/portal/archive/issue32/t32a2.htm

[132] IMO website at http://www.imo.org/

been documented in the majority (84%) of the world's 232 marine ecoregions, with particularly high levels of invasion in Northern California, the Hawaiian Islands, the North Sea, and the Eastern Mediterranean[133]. Areas with a high level of maritime transportation, such as the Wider Caribbean Region, have been identified as particularly vulnerable to invasions.

241. While marine and coastal invasive alien species can be introduced through a number of vectors (commercial shipping, recreational and fishing vessels, aquaculture food and product imports, the aquarium trade and marine debris), shipping remains the main pathway for their introduction. For example, there are between 130 and 340 known introduced marine species in Australian waters, the majority of which are more likely to have been introduced by hull fouling than ballast water[134]. A recent UNEP report[135] also notes that the patterns and pathways of invasions are concurrent with major shipping routes (see figure 8 below).

242. It is thought that the majority of introductions through shipping have taken place through ships ballast water or through hull fouling (the accumulation of unwanted organisms on ships' hulls). A recent analysis by Molnar et al. (2008)[136] drawing on information from over 350 databases and other sources, showed that for the 329 marine invasive species considered, shipping was the most common pathway (69%), with others being aquaculture (41%), canals (17%), the aquarium trade (6%), and the live seafood trade (2%)1. Of the 205 species introduced via shipping – and for which sufficient information was available – 39% were introduced by hull-fouling, 31% via ballast water, and the remainder by both.

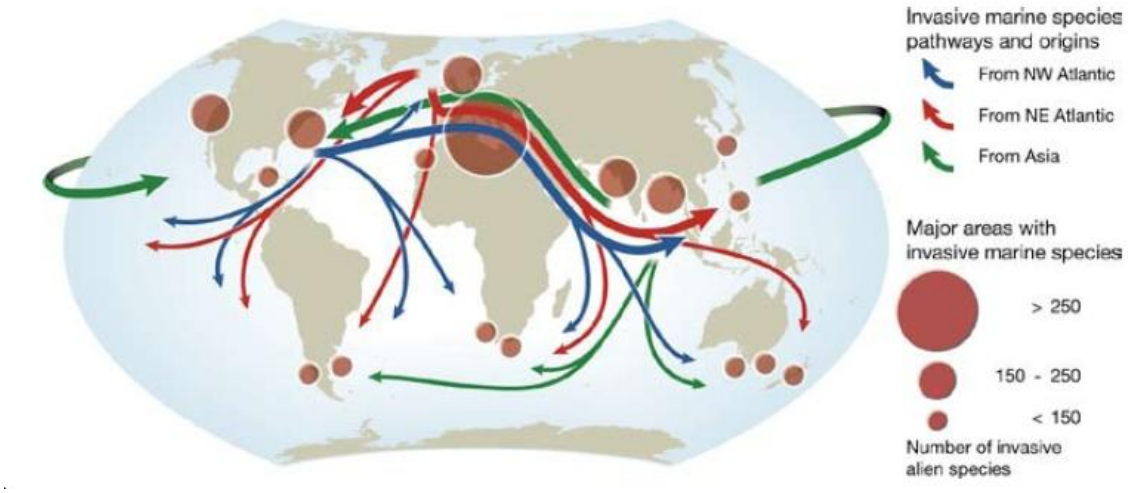


Figure 8: The major pathways and origins of invasive alien species in the marine environment. Note concurrence with major shipping routes. (Source: UNEP-WCMC).

133 Global Invasive Species Programme (GISP) (2008) Marine Biofouling: An assessment of risks and management initiatives. Compiled by Lynn Jackson on behalf of the Global Invasive Species Prorgamme and UNEP Regional Seas Programme. http://www.gisp.org/publications/reports/BiofoulingGuidelines.pdf

134 Sliwa, C., S. Migus, F. McEnnulty, K. Hayes. 2009. Marine Bioinvasions in Australia. Chapter 25 in G. Rilov, J.A. Crooks (eds.) Biological Invasions in Marine Ecosystems. Ecological Studies 204, Springer Verlag, Berlin.

135 Nellemann, C., Hain, S., and Alder, J. (Eds). February 2008. In Dead Water – Merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds**.** United Nations Environment Programme, GRID-Arendal, Norway, www.grida.no

136 Molnar, J.L., Gamboa, R.L., Revenga, C., and Spalding ,M. (2008). Assessing the global threat of invasive species to marine biodiversity. *Front Ecol Environ* 2008;6, doi:10.1890/070064.

243. According to UNEP, some areas are more vulnerable to invasions than others. Firstly, some areas are in more direct proximity to introduction vectors, such as shipping routes. Secondly, areas that are heavily destabilized by human disturbances, such as pollution or overfishing, may be more vulnerable to invasions[137].

244. Governments individually, or working together through regional mechanisms, are undertaking research to better understand pathways of introduction. For example, the Australian Government is funding research to evaluate the translocation risk of marine pests in Australian waters through vessel ballast water discharge and vessel biofouling pathways. It is anticipated that the outcomes of this research will significantly support proposed measures to prevent the introduction and translocation of invasive species through ballast water discharge and biofouling on vessels.

245. In Canada, Fisheries and Oceans Canada is conducting scientific research and monitoring programs; and its Centre of Expertise for Aquatic Risk Assessment conducts biological risk assessments for recent and potential invaders in an effort to protect marine and coastal biodiversity. Over 20 species have been or are being assessed for biological risk. The Canadian Aquatic Invasive Species Network (CAISN) also conducts scientific research to support government policy and other preventative measures to minimize the spread of IAS in Canada's aquatic ecosystems. CAISN contributes to the science-based results needed by aquaculture & shipping industries for the development of technical innovations to reduce new invasions in Canada's marine and freshwater ecosystems.

246. Portugal has started a project called INSPECT (Introduced marine alien species in Portuguese estuaries and coastal areas: patterns of distribution and abundance, vectors and invading potential). The project will run from 2009 to 2011. The objectives of the Project are to study the occurrence patterns of marine alien species in Portuguese estuaries and coastal zones, to evaluate environmental conditions prone to the establishment of potential invasive species, and to contribute to increasing public awareness on this threat. The initial phase will consist of the collection of all relevant information, with consolidation of data and taxonomic validation. The maritime routes, including Portuguese harbours, will be studied to support sampling strategy design. Campaigns and sampling will be directed at different taxonomic groups, namely phytoplankton, zooplankton, algae and invertebrates in mobile and rocky substrata. Sampling will take place in different coastal and estuarine systems, marinas and their neighbouring areas, as well as in ballast water tanks of selected ships.

247. Argentina has undertaken during the last 3 years a project titled "Accidents from the past, decisions in the future: monitoring and education to prevent the introduction of invasive alien species through Patagonian ports", directed by scientists from the National Patagonian Center. Quantitative and qualitative samples of fauna and flora were taken from the principal Patagonian ports and adjacent areas. The sample results show, even if some taxonomic groups are still being studied, that until now no new species were introduced that had not been reported in the past. Also, it was demonstrated that various species had expanded their range of distribution, such as the sea cucumber *Ascidiella aspersa*, the amphipod *Monocorophium insidiosumi* and the hydrozoan *Ectopleura crocea*.

248. Brazil has undertaken a project titled "Ballast Water – Risk Analysis, Management Plan and Monitoring of alien species in the Port of Paranagua, which was launched in 2001. In 2005, the project titled "Preparing Reports on invasive alien species (land and marine environments, human health, production systems and continental waters) was implemented).

137 Nellemann, C., Hain, S., and Alder, J. (Eds). February 2008. In Dead Water – Merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds**.** United Nations Environment Programme, GRID-Arendal, Norway, www.grida.no

249. Within the framework of the Belgian Biodiversity Platform, a Belgian Forum on Invasive Species (BFIS) has been created. This forum gathers scientific information on presence, distribution, auto-ecology, adverse impacts and management of invasive alien species. It regularly updates a reference list of exotic species in Belgium and is responsible for the elaboration of a black list of species with a strong detrimental impact on biodiversity. BFIS has developed guidelines for environmental impact assessment on non-native species in Belgium (ISEIA protocol)138.

250. Regionally, OSPAR is undertaking work to identify priority alien species. However, as noted by OSPAR and a number of other countries, identifying and cataloguing marine invasive species is challenging because additional species are continuously being identified and recognized.

251. Several recent studies document species introductions into Antarctic and Southern Ocean waters. The likelihood of transport of invasive species into the Southern Ocean may increase in future as a consequence of the growth of tourism, fisheries and science activities in the region. It is also possible that global change, particularly global warming, may increase the rate of successful establishment of alien species by reducing differences in environmental conditions between donor and recipient environments. Marine debris and shipping (mainly through hull fouling) are the two major vectors for marine species introductions into the Southern Ocean139.

Impacts of introductions on biodiversity

252. According to GISP, marine invasive species affect biodiversity by displacing native species, by altering community structure, food webs and ecological processes. Invasive species also impact on commercial fisheries, including mariculture, and other natural-resource based industries, with serious economic implications for those communities dependent on them. In addition, fouling of physical structures by introduced species has major impacts on other industries by, for example, decreasing the speed of vessels and clogging water intake pipes140.

253. The economic impact of invasive marine pests is significant. The IMO has estimated that marine pests cost the world tens of billions of dollars every year. Australia reports that while the cost imposed by invasive marine species in Australia has not been well quantified, their impacts on local biodiversity and estuarine and marine industries, such as commercial fisheries and aquaculture, can be considerable. Of most concern is the impact of the northern Pacific seastar *(Asterias amurensis)* on scallop production in Australia (costs Australia AUD$25 million per year).

254. Controlling or eradicating invasive alien species can also have substantial economic benefits. For example, Canada reports that Sea lamprey population levels have been decreased by about 90%. Control efforts have had significant economic benefits, contributing to an estimated $4 billion commercial and sport fishery throughout the Great Lakes.

Box 27. CASE STUDY: Effects of invasive Caulerpa algae

The invasive marine alga *Caulerpa taxifolia* is widely used as a decorative plant in aquaria. In the 1980s, a cold-tolerant strain was inadvertently introduced into the Mediterranean Sea in wastewater from the Oceanographic Museum at Monaco, where it has now spread over more than

138 See also Belgian Forum on Invasive Species http://ias.biodiversity.be/ias/

139 Meliane, I. and Hewitt, C. (2005) Gaps and Priorities in Addressing Marine Invasive Species. IUCN information document, 9pp.

140 Global Invasive Species Programme (GISP) (2008) Marine Biofouling: An assessment of risks and management initiatives. Compiled by Lynn Jackson on behalf of the Global Invasive Species Prorgamme and UNEP Regional Seas Programme. http://www.gisp.org/publications/reports/BiofoulingGuidelines.pdf

13,000 hectares of seabed. New colonies are able to start from small segments of this plant and, being an opportunistic hitchhiker, it is a threat to the whole of the Mediterranean. *Caulerpa taxifolia* forms dense monocultures that prevent the establishment of native seaweeds and excludes almost all marine life, affecting the livelihoods of local fishermen. *Caulerpa taxifolia* is listed by the IUCN Invasive Species Specialist Group as one of the 100 world's worst invasive species. *Caulerpa taxifolia* was discovered in Southern California, USA, in June 2000, where scientists have used solid chlorine blocks to eradicate the pest. If it spreads, it is thought to threaten coastal marine life, including kelp forests, fish, eelgrass beds, marine mammals, and sea birds.

Another invasive Caulerpa, *Caulerpa racemosa*, has also spread widely in the Mediterrean. It is thought to have contributed to a significant reduction in fisheries.

A third algae of the same genus, *Caulerpa sertularioides*, has been recently documented in Costa Rica. The algae is spreading along the reefs of Culebra Bay in Costa Rica's northwestern Gulf of Papagayo, a popular scuba diving spot and home to a rare species of coral. The algae blocks the sunlight and suffocates affected coral reefs. It spreads easily and is very difficult to eradicate.

Operational objective 5.2: To put in place mechanisms to control all pathways, including shipping, trade and mariculture, for potential invasive alien species in the marine and coastal environment

Control of pathways

255. International efforts to control the ballast water pathway resulted in the adoption, in 2004, of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (see box below). There are no international mechanisms to control hull-fouling or biofouling, although some countries (for example, Australia and New Zealand) and regions (for example, the Mediterranean) have adopted measures. In addition, there are no international measures or standards relating to mariculture, although many countries have taken action to control escapees and to prevent genetic pollution (see chapter on mariculture).

Box 28. The Ballast Water Management Convention and its implementation

The International Convention for the Control and Management of Ships' Ballast Water and Sediments was adopted at the IMO in London in February 2004. Among its measures are a requirement for ships to have a Ballast Water Management Plan, maintain a Ballast Water Record Book and whenever possible, conduct ballast water exchange in deep water at least 200 nautical miles from land. The Convention requires ratification by at least 30 states, the combined merchant fleet of which constitutes not less than 35 percent of the gross-tonnage of the world's merchant shipping, in order to enter into force. To date, 16 States have ratified the Ballast Water Management Convention, representing about 14.24% of the world's merchant shipping.

Source: IMO (www.imo.org)

256. According to the CBD 3rd National Reports, 51.96% of all Parties have put in place mechanisms to control pathways of introduction of alien species in the marine and coastal environment, and it is likely that this number is higher at the present time. Countries are also collaborating on regional systems and

strategies to control pathways. Countries are often assisted through international initiatives, such as the UNDP GloBallast Programme (see Box 28).

257. Belgium reports that the intentional introduction of exotic species in the Belgian part of the North Sea is forbidden by law. Actions are also taken in regards to aquaculture, an increasing source of introductions. For instance, any licensee for the production of bivalve mollusks (mussels) is obligated to report the occurrence of exotic species.

258. A number of European countries are collaborating to undertake a scoping study for the implementation of a regional management strategy for ballast water in North West Europe.

259. The HELCOM BSAP (Baltic Sea Action Plan) from 2007 aims to have all Baltic Sea countries ratify the Ballast Water Management Convention preferably by 2010, but in all cases not later than 2013. The HELCOM strategy for managing marine invasive alien species is elaborated upon in the box below.

Box 29. CASE STUDY: HELCOM strategy for managing invasive alien species in the Baltic Sea

Alien species are a major threat to the Baltic Sea ecosystem. Increased maritime traffic has rapidly brought new species to the area, of which many have become established, some have rapidly invaded adjacent areas, and some have replaced native species. According to the Baltic Sea Alien Species Database 120 non-native aquatic species have been recorded in the Baltic Sea area, of which 80 have established viable populations in some parts of the sea area. Many of the species have apparently benefited from the deteriorated state of coastal waters, but others have spread also to more pristine areas. So far, the southern Baltic Sea has faced the greatest pressure by invasions, but in recent years some of these species have also become established in the northern sea areas.

The HELCOM Contracting States have together acted to minimise the threat from non-indigeneous species, e.g by agreeing to ratify by 2010, or at the latest by 2013, the 2004 International Convention on the Control and Management of Ships' Ballast Water and Sediments (BWM Convention). To facilitate ratification, the HELCOM Ballast Water Road Map 28 was adopted as a part of the HELCOM Baltic Sea Action Plan. As a first step in the road map, HELCOM has adopted a list of potential invader species and their characteristics and a list containing the non-indegeneous species currently found from the area. Moreover, the road map contains actions inter alia to establish exchange of information among authorities, compile hydrographic information from major ports and make risk assessments for certain ship routes.

As part of this process HELCOM is jointly with OSPAR requesting vessels transiting the Atlantic or entering the North-East Atlantic from routes passing the West African Coast to conduct on a voluntary basis ballast water exchange before arriving in the OSPAR area or passing through the OSPAR area and heading to HELCOM area, the Baltic Sea. The joint OSPAR/HELCOM General Guidance on the Voluntary Interim application of the D1 Ballast Water Exchange Standard in the North-East Atlantic 29 has been applied from 1 April 2008 and the International Maritime Organization (IMO) has issued a circular on this.

260. In Canada, recommendations regarding ballast water in general and specific recommendations for regional alternative ballast water exchange zones were developed or will be developed for 5 regions in Canada under the auspices of the Canada Shipping Act. Canada is also addressing ballast water from ships through regulations, enforcement, research of treatment technology, research and monitoring to detect further invasive species. The Invasive Alien Species Partnership Program supports projects by

public groups and individuals (e.g. NGOs, industry groups, provincial governments) focusing on: (1) preventing establishment of invasive species through public education; (2) early detection of invasive species; and, (3) management of established populations of invasive species.

261. In 2001, the Australian Government put mandatory ballast water management arrangements in place. These arrangements apply to all vessels entering Australian waters to reduce the risk of introducing harmful exotic marine species into the marine environment via ballast water. Subsequent to the adoption of the Ballast Water Management Convention, Australia is developing nationally consistent ballast water management arrangements that will allow Australia to enhance its management of the risk from marine pest introductions from both internationally and domestically sourced ballast water and sediments. In relation to marine pest risks from biofouling, the Australian Government is developing guidelines, voluntary protocols and regulations for managing marine pest risks from biofouling for all marine sectors including aquaculture, aquarium trade, commercial and recreational fishing, commercial shipping, marinas, slipways, shipyards and dry docks, non-trading vessels, the petroleum industry and recreational vessels.

262. In addition, Australia has developed National System for the Prevention and Management of Marine Pest Incursions. The national system includes the management of all potential vectors, emergency preparedness and response, and ongoing management and control of introduced marine pests.

263. Argentina reports that it has signed the agreement on ballast water and has joined the Phase II of the GloBallast programme in 2008. The objective of this project is to strengthen the institutional, legal and policy aspects to prevent the introduction of alien species through ballast water. The GloBallast programme is described in the box below.

Box 30. CASE STUDY: The GlobaBallast programme

The GloBallast programme focuses on enhancing developing country capacity to reduce the environmental and socioeconomic risks associated with the transfer of aquatic invasive species in ship ballast water, the principal vector for exotic species introductions. The pilot phase of GloBallast was designed to help developing countries prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships ballast water and sediments. The project, conducted in partnership with the IMO, established demonstration sites, national lead agencies and information clearing houses, assisted with laws and regulations, increased awareness and expertise, established best practices and stimulated innovative ballast water management solutions. The project also developed mechanisms for compliance monitoring and enforcement.

Six demonstration sites were chosen as representative of the six main developing regions of the world - South America, East Asia, South Asia, Arab Countries/Persian Gulf, Africa and Eastern Europe – have been developed into “centers of excellence” in ballast water management, and have helped catalyse regional agreements and strategic action plans.

Port Baseline Surveys were made of native biota and introduced marine species in each pilot country and assessments undertaken to assess the risk of alien species introduction. Training packages were developed to train administrators, port and shipping personnel in IMO guidelines for ballast water management and ballast water legislation in each country was evaluated and improvements suggested.

Awareness and expertise were increased though training and awareness campaigns. Best practices and standard models were established for technical activities and innovative and technical innovations–such as “flow through” ballast water, UV or ozone sterilization were supported.

In 2007, a total of $23 million in new financing was mobilized for a new phase, GloBallast Partnerships**,** representing a significant upscaling and replication of the pilot project. GloBallast Partnerships which will assist developing countries to reduce the risk of aquatic bio-invasions mediated by ships ballast water and sediments and will expand and build on the successfully completed GEF-UNDP-IMO pilot project. With the help of tools developed and lessons learned from the pilot project, the GloBallast Partnerships project will expand government and port management capacities, instigate legal, policy and institutional reforms at the country level, develop mechanisms for sustainability, and drive regional coordination and cooperation. The project will spur global efforts to design and test technology solutions, and will enhance global knowledge management and marine electronic communications to address the issue. The partnership effort is three-tiered, involving global, regional and country-specific partners, representing government, industry and non-governmental organizations. Private sector participation will be achieved through establishing a GloBallast Industry Alliance with partners from major maritime companies. 13 countries, from 6 high priority regions, have agreed to take a lead partnering role focusing especially on legal, policy and institutional reform. All told, more than 70 countries in 14 regions across the globe will participate, including the six pilot countries whose expertise and capacities will be drawn on for this global scaling-up effort.

Source: UNDP voluntary report on the implementation of the programme of work

264. Regional organizations are undertaking activities related to marine and coastal invasive alien species. PERSGA is coordinating workshops for four country members on ballast water management. OSPAR has developed Voluntary Regional Ballast Water Management Guidelines. NOWPAP is developing a draft project proposal on alien species for consideration for approval by member states in 2009.

265. Various guidance documents have also been developed by organizations. The International Council for the Exploration of the Sea (ICES) developed in 2004 a Code of Practice on the Introductions and Transfers of Marine Organisms. GISP in partnership with UNEP Regional Seas has prepared Marine Biofouling Guidelines for the prevention and management of invasive marine species[141]. GISP has also developed training courses on Management of marine and coastal invasive species[142].

266. The World Ocean Council (WOC) is creating cross-sectoral private sector leadership group on marine invasive species to advance the development and implementation of solution technologies and operating procedures. However, there is slow progress in developing and implementing solutions to marine invasives by a critical mass of industry operators. The WOC notes the need to create incentives for a leadership group to implement solutions in advance of global regulations coming into force.

Eradication or management of already introduced species

267. Once a marine invasive species has established itself, it is very difficult if not impossible to eradicate it. While comprehensive information about marine eradications is lacking, there are two successful cases of documented eradications of marine invasive species – the black striped mussel from three marinas in Darwin, Northern Australia[143] and the abalone tapeworm off California, USA[144].

[141] http://www.gisp.org/publications/reports/BiofoulingGuidelines.pdf

[142] http://www.gisp.org/publications/courses/list.asp#marinemanagement

[143] Bax N, Hayes K, Marshall A, Parry D, Thresher R (2002) Man-made marinas as sheltered islands for alien marine organisms: establishment and eradication of an alien invasive marine species.In: Veitch CR, Clout MN (eds) Turning the tide: the

Information about successful management of marine invasive alien species can also be found in Australia's national and voluntary reports.

268. The Australian Government has developed national control plans (NCPs) for six agreed national marine pests of concern that have established in Australia. The species of agreed concern are *Asterias amurensis* (northern Pacific seastar), *Carcinus maenas* (European green crab), *Musculista senhousia* (Asian date mussel), *Sabella spallanzanii* (European fan worm), *Undaria pinnatifida* (Japanese seaweed) and *Varicorbula gibba* (European clam). An implementation strategy for each of the NCPs is being developed.

269. The Rapid Response Toolbox is a web-based database of control options for the 12 target species on the 1994 Australian Ballast Water Management Advisory Council (ABWMAC) target pest list. Potential control options held in the Rapid Response Toolbox can be accessed in two ways, either by browsing the lists of control methods by category (Chemical, Physical or Biological), or by searching for the control options listed for a specific taxon (using scientific or common names). http://www.marinepests.gov.au/nimpis

Operational objective 5.3: To maintain an incident list on introductions of alien marine species

270. This section provides a list of databases and other incident lists of invasive alien marine species that are global, regional or national. A short description is provided for each. This list is likely not complete.

The Global Invasive Species Database
(http://www.issg.org/database/welcome/)
The Global Invasive Species Database (GISD) aims to increase awareness about invasive alien species and to facilitate effective prevention and management activities. It is managed by the Invasive Species Specialist Group (ISSG) of the Species Survival Commission of the IUCN-World Conservation Union. The Global Invasive Species Database focuses on invasive alien species that threaten native biodiversity and covers all taxonomic groups from micro-organisms to animals and plants in all ecosystems, including marine. Species information is either supplied by or reviewed by expert contributors from around the world.

The FAO Database on Introductions of Aquatic Species (DIAS)
(http://www.fao.org/fishery/dias)
The database includes records of species introduced or transferred from one country to another.

The Baltic Sea Alien Species Database
(http://www.corpi.ku.lt/nemo/)
The objectives of the database are: (i) to provide a qualified reference system on alien species for the Baltic Sea area, available online for environmental managers, researchers, students and all concerned; (ii) to update the information on the Baltic Sea alien species, their biology, vectors of introduction, spread, impacts on environment and economy; and (iii) to encourage the exchange of data among different geographical regions and thereby to serve a node in the Global Information System for Invasive Species.

CIESM Atlas of Exotic Species in the Mediterranean

---

eradication of invasive species.InvasiveSpecies Specialist Group of the World Conservation Union (IUCN) Auckland NZ, pp 26–39

144 Culver SL and Kuris AM. (1998) The apparent eradication of a locally established introduced marine pest. Biological Invasions2:245–53.

(http://www.ciesm.org/online/atlas/index.htm)
The CIESM Atlas of Exotic Species is the first attempt to provide a comprehensive, group by group, survey of recent marine "immigrants" in the Mediterranean, which is undergoing drastic and rapid changes to its biota. Many of these new species are of Indo-Pacific origin having reached the Mediterranean Sea through the Suez Canal: these so called "Lessepsian" migrants now contribute significantly to the biodiversity of the Eastern basin. The Atlas is a guide for researchers, environmental planners and non-specialists who are interested in or likely to encounter marine species that are not native to the basin. Because of observations and records of these new and often rare species the Atlas will expand as our knowledge on the distribution and ecology increases.

The IABIN Invasives Information Network (I3N)
(http://i3n.iabin.net/)
The IABIN Invasives Information Network (I3N) integrates information from Western Hemisphere countries to support the detection and management of invasive alien species. I3N provides capacity building, electronic tools, and support for database development and increased access to information. It contains some information on marine species. The countries covered include Argentina, Brazil, Colombia, Costa Rica, Ecuador, Jamaica, Paraguay and Uruguay.

An information system for marine introductions in Australia (NIMPIS)
(http:// www.marinepests.gov.au/nimpis)
The National Introduced Marine Pest Information System (NIMPIS) was developed to provide managers, researchers, students and the general public with access to accurate and up to date information on the biology, ecology and distribution of introduced marine species, and potential control options for those designated as pests. Included within this system are (i) species that are known to be introduced to Australian waters and (ii) those species that are considered to be likely future introductions ('next pests').

The Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) Trigger List
The Consultative Committee on Introduced Marine Pest Emergencies coordinates the national operational response for Australian marine pest emergencies. A list of species not yet established in Australia, but likely to have significant impacts if introduced, is maintained (the CCIMPE Trigger list). This list assists with the rapid response to new incursions. A baseline survey of thirty five key locations has been completed to establish their pest status. An ongoing monitoring program is under development. The program has been trialled in two locations and is intended to be completed regularly (every 1-2 years) in a minimum network of 18 locations. No website was available.

VLIZ list of non-native species in the Belgian part of the North Sea and adjacent estuaries
http://www.vliz.be/NL/Cijfers_Beleid/nietinheemsLIJST
Flanders Marine Institute (VLIZ) in collaboration with the VLIZ alien species consortium maintains a list of established alien (non-native) species and draws up information files for all settled/established alien species in the Belgian part of the North Sea and adjacent estuaries.

Directory of non-native marine species in British waters
(http://www.jncc.gov.uk/page-2597)
A review and directory, which collates details and reviews information about introductions of marine fauna and flora to Great Britain (England, Scotland and Wales).

The Aquatic Invasive Species (AIS) database (Canada)
The database is an application for storing scientific observations on AIS and to provide a centralized location for all AIS data. The database will increase communication of AIS

monitoring between scientists, strengthening our ability to address this threat to Canadian ecosystems. This database does not seem to be on-line as of yet.

The National Ballast Information Clearinghouse (NBIC) (USA)
(http://invasions.si.edu/nbic/index.html)
The clearinghouse is a joint program of the Smithsonian Environmental Research Center (SERC) and the United States Coast Guard that collects, analyzes, and interprets data on the ballast water management practices of commercial ships that operate in the waters of the United States.

National Exotic Marine and Estuarine Species Information System (NEMESIS) (USA)
(http://invasions.si.edu/nemesis/index.html)

Delivering Alien Invasive Species Inventories for Europe (DAISIE) (Europe)
(http://www.europe-aliens.org/index.jsp)
The DAISIE website, *inter alia*, offers the possibility to explore alien species threats across Europe, for 48 coastal and marine areas.

Conclusions

271. Marine and coastal invasive alien species remain a serious problem throughout the world, and once invasive species are established, they are difficult to eradicate or manage, particularly in the marine environment. The ballast water vector is now being dealt with through the International Convention for the Control and Management of Ships' Ballast Water and Sediments; however this convention has not yet entered into force. Major pathways for introductions, in particular biofouling, still remain to be controlled through international efforts. Considering the apparently large contribution of biofouling to marine invasions, this issue should be addressed as a matter of urgency. The mariculture and marine litter vectors may also need further consideration. Finally, any strategy for the prevention of new invasions would also need to take into consideration that marine pollution and degradation of habitats make ecosystems more vulnerable to invasions, and thus should include building ecosystem resilience through improved management and protection.

BARRIERS TO IMPLEMENTATION OF THE PROGRAMME OF WORK AND PRIORITIES FOR CAPACITY BUILDING TO ADDRESS THE BARRIERS

272. In their national and voluntary reports CBD Parties provide a list of challenges and/or obstacles to implementing the programme of work. These obstacles are summarized here, together with capacity building priorities.

(a) **Lack of political commitment and support, and unstable political situations**: This is often due to poor understanding of the benefits, goods and services provided by biodiversity and its contribution to sustainable development, including failure to fully value ecosystem services. It can lead to lack of leadership; low national priority for biodiversity conservation; a poor understanding of national commitments and international obligations; poor regional cooperation; and a mindset that we cannot control biodiversity loss, that targets will not be met and that scientific advice is 'alarmist'.

The economic benefits and values of marine and coastal biodiversity are often not well understood by decision-makers. While economic valuation activities have recently become more common, and have been effectively used to argue for conservation, they have generally focused on selected ecosystems, such as coral reefs. Much less is known, for example, about the economic values of deep sea ecosystems. While studies have calculated the costs of conservation action (for example how much it would cost to establish a network of MCPAs), there has been little focus on calculating the economic costs of inaction (failing to

undertake conservation measures) in the long term. The use of marine resources is still often focused on short-term gains rather than long term benefits.

(b) **Lack of integration of environmental, social and economic objectives**: Mainstreaming remains one of the major challenges for implementing the programme of work on marine and coastal biodiversity. Biodiversity in the oceans and coasts is affected by activities of other sectors, including fisheries, forestry, agriculture, coastal development and planning, and shipping. Biodiversity will continue to decline unless these sectors incorporate biodiversity-relevant priorities into their activities. Mainstreaming requires both horizontal integration (integration between various departments and agencies representing various sectors) and vertical integration (integration between various levels of government).

While mainstreaming seems to have been strongest in countries where biodiversity is self-evidently a crucial component of national wealth (for example, in the form of tourism income), in many cases mainstreaming on the national level is not enough to achieve positive biodiversity outcomes in the marine environment. Local biodiversity managers are often faced with impacts that are regional or global in nature. For example, management measures implemented by a coral reef manager can be undermined by global climate change impacts, such as coral bleaching and acidification. National measures to control land-based sources of marine pollution do not have desired effects if neighbouring countries fail to take similar measures. And national fisheries management measures may be undermined by distant water fishing fleets or by IUU fishing.

(c) **Institutional and policy obstacles and weaknesses:** Lack of vision, attitude and perceptions; lack of inter-sectoral coordination; conflicting or inadequate legislation; lack of legislation; contradictory government policies limiting opportunities; lack of multi-stakeholder coordinating mechanisms; limited marketing strategies for MCPA 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 MCPAs; lack of cooperation between NGOs and government institutions.

Management measures are often undertaken only after there is undeniable, or even drastic, evidence of biodiversity decline, and the precautionary approach is only implemented in a limited fashion. Many marine species are slow-growing and mature late, and thus are vulnerable to exploitation. Additionally, there is a limited degree of knowledge about the structure and functioning of marine ecosystems, leaving management to cope with a large degree of uncertainty.

Coordination between fisheries and environmental/biodiversity agencies is often limited nationally, regionally and globally. On the national level, this may result in unsustainable exploitation. Internationally, there is a lack of collaboration and trust between the processes, resulting in duplicated efforts, multiple guidelines and policies.

(d) **Insufficient human technical resources and capacity**: Inadequate and poorly qualified staffing; lack of incentives for dedicated staff; non-continuity of trained personnel and change of staff. Lack of capacity to enforce existing laws and regulations.

Enforcement of laws and regulations can present additional difficulty in ocean areas. Few countries have the resources to patrol extensive coastal areas and entire EEZs. The enforcement of regulations in marine areas beyond the limits of national jurisdiction is even more challenging, as technology, such as vessel monitoring systems, can be tampered with. In many cases, even if enforcement is carried out, fines are not sufficiently high to act as deterrents.

(e) **Limited financial resources**: Insufficient government allocations, with marine and coastal biodiversity a low priority; uncertainties relating to future funding, or the sustainability of current funding in the long term; lack of compensatory mechanisms; high reliance on one source of funding; lack of local capacity to generate revenue; resistance to creating new taxes.

Substantial amounts of money are required to implement IMCAM and manage MCPAs, particularly as such management measures extend to cover national EEZs. In addition, implementation and enforcement of international and regional agreements relating to oceans and coasts is expensive. It is often necessary to provide economic alternatives (or even, in some cases, monetary compensation) to people whose traditional or future use of marine resources may be limited by new systems for the conservation and sustainable management of those resources. Without sufficient funding for management, MCPAs may become paper parks, and international agreements for managing marine resources may turn out to be little more than statements of good intentions. Unfortunately, funding for conservation is often one of the first government budget items to be cut in times of economic difficulties.

(f) **Lack of suitable data**: Poor data collection and analysis with lack of standardization; little understanding or documentation of biodiversity loss; limited use of existing scientific and traditional knowledge; scientific information does not meet management needs, or is not presented in a format understandable to managers; scientific consensus is difficult to achieve, takes a long time, and can impede pragmatic decision-making; difficulty in managing, researching and monitoring remote oceanic locations; in the deep ocean, poor understanding of what we have and what we have to lose.

Possible impediments to the development of an effective ecosystem evaluation and assessment approach include the ability to identify appropriate indicators that are easy to measure, and accurately reflect changes in the marine environment. The remoteness of many marine locations makes monitoring more costly, while deep sea areas require specialized and expensive equipment and ship time. Even coastal monitoring is constrained by resources, as long-term monitoring programmes are often difficult to fund, and require the deployment of expensive human resources.

(g) **Low awareness**: by the general public, biodiversity managers, and/or politicians of the status of biodiversity, the importance of conservation, and of the requirements of the CBD. CBD COP decisions not necessarily transmitted to marine biodiversity managers; lack of policies or legislation to implement COP decisions; existing policies not developed with public participation. Danger that each generation redefines what is 'natural'.

Much of the oceans are remote and out of sight. While the effects of coastal eutrophication or the decline in nearshore coral reefs are readily observable, biodiversity decline further offshore is not necessarily evident. Damage caused by bottom fishing gear, such as trawls, remains hidden, though it has an impact on biodiversity and fisheries resources. The Eastern Pacific Garbage Patch – a large area characterized by exceptionally high concentrations of suspended plastic and other debris trapped by the currents of the North Pacific Gyre – was only discovered in 1997. Much of deepsea biodiversity still remains to be discovered.

(h) **Insufficient training in the use of guidelines and tools and inadequate dissemination of such materials**: Lack of simple, easily understandable methods and guidance in local languages; training and information on economic valuation of biodiversity and MCPAs, fund-raising (resource mobilizations), and in GIS and mapping. Guidelines and similar tools are not necessarily the best means for people to learn complex activities such as IMCAM or MCPA management unless accompanied by appropriate training; sharing of experiences through workshops and exchange visits are also valuable.

Recent years have seen the arrival and increasing use of approaches such as marine spatial planning and ecoregional planning. Managing multiple human uses in large ocean areas requires sophisticated tools and methods, including ecosystem models, and the ability to combine information relating to ecosystems, threats and human activities. Additionally, deep sea research and marine biotechnology also require high levels of scientific expertise, instrumentation and research vessels. All of these new technologies create increasing demand for training, both in regards to short targeted courses and longer-term career development, as well as technical assistance and the sharing of resources in deep sea research.

(i) **Limited or low involvement of indigenous and local communities and various stakeholders**: Inadequate involvement of indigenous and local communities; conservation measures not culturally appropriate or do not respect local social structures; conservation measures may displace communities or affect their livelihoods; inadequate participation of scientific and academic community; limited public participation; lack of information about socio-economic and cultural aspects of conservation and lack of information about coastal communities affected by conservation measures; social vulnerability and poverty of coastal communities; lack of support or recognition of community-led initiatives for biodiversity conservation.

Many coastal communities have traditional methods, including area-based restrictions, to facilitate recovery of marine resources. These methods differ from the western conservation approach by considering community benefits as the central management goal. The western scientific model for marine conservation may not be appropriate for all cultures and communities. In some cases, application of this model has resulted in social and cultural losses for coastal communities, including in particular fishermen. While there is increasing recognition of the value of traditional management systems in conservation programmes, as well as successful MCPA networks integrating both traditional and scientific knowledge, government legislation and/or policy is sometimes in conflict with community resource allocation systems. Additionally, top-down conservation approaches may not be successful due to lack of community support.

(j) **Lack of economic incentives**: Lack of adequate mechanisms of sharing benefits arising from the use of biodiversity resources; and limited technology transfer.

The costs and benefits of conservation measures, such as MCPAs are not evenly distributed. Some groups may end up benefiting more, while others carry a larger amount of the costs. Additionally, the costs of setting up and MPCA are immediate, while benefits are often only realized many years later.

Policy and legislation relating to marine genetic resources is lacking in many countries, and there are relatively few examples of benefit-sharing relating to the marine environment. This situation is likely to improve with the adoption of the international regime on access and benefit-sharing.

273. The Parties also identified priorities for capacity building in order to overcome the identified obstacles. The following list summarizes those priorities.

(a) **Enhancing cross-sectoral coordination and policy planning in regards to marine and coastal areas**: For effective implementation of IMCAM and other initiatives, coordination and integration needs to be further enhanced, both on the legal and the institutional level. This generally requires the development of a coordination mechanism or a body, such as an IMCAM working group or committee comprised of representatives of all involved sectors, and agreement on a common vision and actions to address issues of common concern. In particular, strong national coordination between fisheries and environmental departments is important. In addition, regional coordination between neighbouring countries is vital for successful IMCAM efforts in many areas with strong ecosystem connections and/or shared species. The case study below, from South Africa, highlights the development of an integrated coastal management process.

Box 31. CASE STUDY: Establishment of integrated coastal management in South Africa

In the past, South Africa has experienced challenges in coastal management due to inadequacies, including lack of acknowledgement of the value of the coast that led to inappropriate decision-making for coastal development, especially environmentally insensitive development and activities that have led to over-use, degradation and inappropriate management of the coast.
The Integrated Coastal Management Act was passed by parliament in 2008 after extensive consultation and public submissions, and signed into law early in 2009. The new Act promotes a

holistic approach to coastal management by viewing the coast as a system and managing it in a co-ordinated and integrated manner.

The Act establishes a system of integrated coastal and estuarine management to promote the conservation of the coastal environment and maintain the natural attributes of coastal landscapes and seascapes, while ensuring that development and the use of natural resources within the coastal zone is socially and economically justifiable and ecologically sustainable. The Act further defines rights and duties of organs of state in relation to coastal areas – this seeks to overcome the previous shortcomings of fragmented planning and decision-making where several sectors of government focused on their areas of interest, such as land-use planning, agriculture, water affairs and conservation, without efforts being co-ordinated. Planning and decision-making will no longer be sectoral, but implemented through integrated planning and decision-making by the establishment of a National Coastal Management Committee, which has provincial, municipal and national representation. Provincial and Municipal Coastal Committees will also be established to promote integrated implementation of the Act.

The Act requires that within four years of it coming into effect, a national coastal management programme must be prepared and adopted for managing the coastal zone – this policy directive will provide for an integrated, co-ordinated and uniform approach to coastal management by organs of State in all three spheres of government, NGOs, the private sector and local communities. Provincial and municipal coastal management programmes are similarly required. The coastal management plans must be aligned with other statutory plans, including municipal Integrated Development Plans.

Source: South Africa's 4th National Report

(b) **Enhancing coordination between levels of government, with emphasis on local implementation**: As with sectoral coordination, this requires the establishment of a coordinating mechanism or process to ensure harmonized implementation of policies and flow of information related to COP decisions and their implementation between levels of government. Community-driven and/or locally implemented initiatives may often be particularly effective for meeting biodiversity conservation and sustainable use objectives, particularly when such measures are enabled by national legislation, as illustrated in the case study from Brazil below.

Box 32. CASE STUDY: Marine Extractive Reserves (MER) and Marine Sustainable Development Reserves (MSDR) in Brazil

In Brazil the establishment of MCPAs has, in the past, created many conflicts between artisanal fishermen and protected area authorities. Most of these conflicts resulted from restriction of artisanal fishing activities in areas traditionally used by these fishermen. In many cases the conflicts appeared as result of the fact that these protected areas were created without participation of fishing communities.

In 2000, when a new National System of Protected Areas was created, new categories were established, particularly Marine Extractive Reserves (MER) and Reserves for Sustainable development (RSD), where sustainable uses provide the means to achieve biodiversity conservation and improvement in the living standards of fishermen. A legal framework has been created for the participation of coastal communities in the establishment and management of these reserves. Under this system, traditional fishing communities apply to be given exclusive rights to exploit the fish or shellfish of an environmentally-sensitive area, under a strict management plan that guarantees the integrity of the coastal ecosystem. The reserves have succeeded in providing biodiversity benefits, as well as economic benefits for coastal communities. In recent years the demand for establishment of sustainable use reserves by fishing communities has greatly increased. In the most recent reserve to be approved, the complaint of the local population was about long delays in getting official designation from the federal government – a contrast to situations in which communities protest against restrictions introduced in protected areas imposed from above.

Sources: Draft GBO-3 and http://www.usp.br/nupaub/english/wionspapers.pdf

(c) **Developing and strengthening stakeholder networks**: Working with an extensive network of stakeholders, while central to the effectiveness of activities to conserve and sustainably use biodiversity, is costly in terms of time and resources. However, these time and resource requirements can be minimized by developing and strengthening stakeholder networks to ensure that timely information is received to inform the decision making process as efficiently as possible.

(d) **Demonstrating economic and social value of marine and coastal biodiversity**: Quantifying the economic and social values of marine and coastal biodiversity and ecosystem goods and services is essential if politicians and government officials are to be convinced of the need for their protection and management. This will also allow for biodiversity loss to be related to economic costs. As illustrated in the case study from Kenya below, economic valuation can increase support for a MCPA and help address equity-related issues.

Box 33. CASE STUDY: An economic valuation of an MPA in Kenya

Kisite Marine National Park and Mpunguti Marine National Reserve, administered by the Kenya Wildlife Service (KWS), are together an important tourist destination, and also contribute to fisheries. Exploitation is banned in the Marine Park while fishing using traditional methods is permitted in the Marine Reserve. An economic valuation was carried out, with the support of IUCN and with funding from BMZ-the German Federal Ministry for Economic Cooperation and Development, to help identify how the financial and management problems faced by the MPA could be addressed. It was found that, in 1999, the Marine Park and Reserve was generating income in excess of US$1.6 million a year in net revenues from tourism, and a further US$39,000 from fisheries. These returns are far in excess of the estimated management and opportunity costs associated with the park of some US$190,000 a year. If other economic benefits of the MPA, such as its contribution to shoreline protection, marine productivity, wildlife habitat and nursery, cultural and aesthetic values, had also been factored in, its economic benefits would have been even greater.

The valuation was also able to demonstrate that some groups (primarily the commercial tourism operators) receive the main economic benefits from the MPA, but others (the local fishing communities who had reduced fishing opportunities, and the local KWS office which had to manage the area although the entrance fee proceeds are managed centrally by KWS) bear the costs. Once this had been shown, activities were initiated to rectify the imbalance, focusing particularly on increasing benefits to local communities. These included constructing a mangrove boardwalk that is managed by the village womens' group, and helping local boat operators to improve their services to tourists (e.g. preparation of an information leaflet and code of conduct, and assistance with obtaining appropriate insurance). These activities have led to a marked increase in support for the MPA by the local communities.

Source: Emerton, L. & Tessema, Y. 2001. Economic Constraints to the Management of Marine Protected Areas: the case of Kisite Marine National Park and Mpunguti Marine National Reserve, Kenya. IUCN Eastern Africa Programme, Nairobi, Kenya. 26pp. Also, WIOMSA at http://www.wiomsa.org/mpatoolkit/Themesheets/E6_Economic_valuation.pdf

(e) **Undertaking periodic review of the adequacy of policies and legislation and their implementation**: This review is needed to understand to what extent legislation has achieved its objectives, and to ensure its continued effectiveness. An assessment is also needed of whether the existing measures to protect and manage marine and coastal biodiversity are effective, and to what extent they have been implemented. This will have the added benefit of providing for COP decisions to be translated into policies regularly.

(f) **Securing resourcing and funding through forward planning**: Lack of financial resources is one of the most common impediments to implementing measures for conservation and sustainable use of marine and coastal biodiversity. There is a need for improved and forward-looking financial planning, fund-raising and business planning skills, ways and means of making marine protected areas and networks financially self-sustaining, improved funding for research to support management, and additional donor funding, including small grants. Relating biodiversity loss to economic costs may also help in securing government funding. The case study below illustrates a novel transboundary funding mechanism for the Mesoamerican Barrier Reef.

Box 34. CASE STUDY: The Mesoamerican Reef Fund (MAR Fund)

The Mesoamerican Reef Fund (MAR Fund) is a non-profit corporation created by four environmental funds from México, Belize, Guatemala, and Honduras, as a financial mechanism for conservation and adequate resource use in the Mesoamerican Reef Ecoregion. This new conservation finance mechanism is unique in that it is the first environmental fund in the Western Hemisphere that transcends the national boundaries of four countries to encompass an entire ecoregion.

The MAR Fund is a participatory, privately managed fund with a Board of Directors comprised of regional funders, experts, and the in-country funds from each of the Mesoamerican Reef countries - PACT (Belize), Fundación para la Conservación de los Recursos Naturales y Ambiente en Guatemala (FCG), Fundación Biósfera (Honduras), and Fondo Mexicano para la Conservación de la Naturaleza (Mexico).

The goals of the MAR Fund are (1) to provide long-term financial sustainability for natural resources management and conservation initiatives in the MAR ecoregion, (2) to strengthen the alliance among the four participating funds, and (3) to consolidate and allocate donor contributions to common and strategic objectives in the ecoregion.

Source: http://www.marfund.org/

(g) **Enhancing capacity of personnel through training**: Some of the training needs identified included selection and use of ecological and social indicators and methods for ecological, social and economic assessment and monitoring; marine taxonomy; marine protected areas management; methodologies for selecting sites of MCPAs and developing networks; economic valuation; training for communities on legislative and policy frameworks; training for government officials and managers on implications of policy measures on small-scale fishers; use of interdisciplinary methodologies for conservation planning; training on methods for community participation and conflict resolution; and training to communities on importance of marine and coastal biodiversity and marine protected areas, as well as community-based monitoring methods.

(h) **Making scientific information and traditional knowledge easier to access through improved information management:** This might include an information system or database on existing information on marine and coastal biodiversity, publications and research projects. Information needs of management would need to be identified as a first step, and existing projects, research activities and available information related to those needs. As a result, information gaps can be identified, and available funding for further research strategically invested to fill those gaps.

(i) **Scaling up demonstration projects:** As demonstrated by the PEMSEA initiative on IMCAM Demonstration Sites (see case study in chapter on IMCAM), small local initiatives provide a valuable opportunity to test management methods and can be scaled up to include surrounding areas.

(j) **Developing regional collaboration to address scientific information needs:** A regional network of institutions, universities or marine laboratories can collaborate to address management information needs in their areas of expertise, avoiding overlap and ensuring that all important research

needs are covered. This requires strong coordination, dialogue with management entities, and information sharing. Knowledge networks, such as the Pacific Invasives Initiative have also proven to be successful and cost-effective.

(k) **Develop or further enhance spatial approaches to data management:** Marine spatial planning and ecoregional planning requires spatial datasets about ecosystems, species and human uses. This, in turn, requires specialized skills and software. In particular, methods for dealing with data poor situations are required.

(l) **Develop international scientific expertise and processes for assessing and managing poorly known ocean areas such as the deep sea, and to provide information about the status of marine biodiversity globally, as well as management options:** There is a need for up-to-date information about the status and trends of marine biodiversity globally. Expertise relating to deep sea biodiversity is also lacking. This need will hopefully be answered in part by the UN "Regular Process" and/or by a continuation of the Census of Marine Life and the Millennium Ecosystem Assessment. There is also a need for further research to answer management questions of global importance, for example to fully understand the potential and risks related to hull fouling and invasive species. Training of scientists from developing countries and technology transfer should be part of these efforts.

Box 35. CASE STUDY: Towards a regular process for the global reporting and assessment of the state of the marine environment, including socio-economic aspects

At the present time there are no comprehensive assessments of the world's marine environment. Regional assessments exist in some areas; certain ecosystems, such as coral reefs are regularly monitored; and global assessments (such as the Millennium Ecosystem Assessment and the Global Environment Outlook) address some aspects of the state of oceans and coasts. However, these together do not present a cohesive or comprehensive picture of the status and trends of biodiversity in the world's oceans. To address this gap, the Johannesburg Plan of Implementation, in paragraph 36(b), called for the establishment by 2004 of a regular process under the United Nations for global reporting and assessment of the state of the marine environment, including socio-economic aspects, both current and foreseeable, building on existing regional assessments. While this assessment has been under development for a considerable time, momentum was gained in 2005, when the United Nations General Assembly endorsed the need for a regular process for global reporting and assessment of the state of the marine environment.

As part of a start-up phase, an "Assessment of Assessments" has been undertaken to collect information about existing marine assessments, and to propose a way forward. It was requested by governments in order to serve as one of the main foundations for the development of a regular process for the global reporting and assessment of the state of the marine environment, including socio-economic aspects. It builds on the work done by other international forums and, either directly or indirectly through those forums, by national authorities concerned with the marine environment. The Assessment of Assessments will be considered by the *Ad Hoc* Working Group of the Whole (31 August – 4 September 2009**)**, established through UN General Assembly Resolution 63/111. This Ad Hoc Working Group will recommend a course of action to the General Assembly at its sixty-fourth session

While it is still difficult to tell the timeline and format for the establishment of a regular process for the global reporting and assessment of the state of the marine environment, including socio-economic aspects, it is likely that this effort will address future information needs on the national, regional and global levels. It is also likely to address capacity building needs and support policy decisions made in fora such as the CBD.

Further information is available at http://www.unga-regular-process.org/

(m) **Identify areas of global ecological and biological significance in marine areas beyond the limits of national jurisdiction:** Because these areas cannot be protected by any individual country, there is a need for a collaborative international effort towards identification and conservation of those areas of global ecological and biological significance, in accordance with international law, as reflected in the UN Convention on the Law of the Sea, and using, as appropriate, the CBD criteria.

(n) **Improve enforcement of existing legislation relating to conservation of marine environments and species**: Laws are often made meaningless by the lack of capacity for enforcement. Community-based and voluntary enforcement methods have had success in many areas, particularly where strong social networks exist, but may not be sufficient for other areas.

(o) **Implementing solutions to specific industry impacts on marine biodiversity:** This includes creating awareness and understanding amongst industry of the ecosystem approach, marine biodiversity and marine spatial planning; developing regional ocean business councils; and strengthening efforts to create a global cross-sectoral industry alliance to constructively engage in UN and other international processes relevant to oceans, though organizations such as the World Ocean Council. Many ocean industry sectors are moving to establish higher quality standards for a variety of products and practices in relation to marine resources or operations in the ocean environment. This is being led by companies and by industry associations. For example, Unilever, one of the world's largest fish purchasing and processing companies, has committed to sourcing only sustainable, Marine Stewardship Council certified fish in the future.

Box 36. CASE STUDY: Implementing carrying capacity assessment and strategic environmental assessment towards coastal tourism development in Egypt

The existing tourism development patterns in the Fuka-Matrouh area of coastal Egypt have had a tendency to produce tourism saturation and uncontrolled development, with short-term benefits and extensive use of resources. The contribution of tourism to local economic development was low. These issues were amongst those addressed by the Fuka-Matrouh Project, an integrated coastal area management project supported by the Mediterranean Action Plan (MAP) Coastal Area Management Plan (CAMP).

Two innovative approaches: carrying capacity assessment and strategic environmental assessment were applied to produce sustainable coastal tourism outcomes.

The carrying capacity assessment allowed tourism planning and development to consider a combination of environmental, cultural and socio-economic parameters. Although more difficult to quantify, the socio-economic and cultural parameters turned out to be crucial for tourism development in the area, and allowed the calculation of maximum accommodation capacity. This information was vital for the development of a coastal management plan.

Although existing EIA provisions were considered rather comprehensive and sufficient for controlling future coastal projects, there was a need for a tool that allows consideration of environmental impacts over larger geographical areas and longer timeframes. Strategic Environmental Assessment (SEA) is a tool that allows assessment of cumulative, secondary, long-term and delayed impacts. This provided the responsible authorities an opportunity to anticipate the cumulative impacts of a number of similar projects, which, if considered individually, may not impose danger to the environment, but assessed as a whole may show quite a different picture.

Source: Mediterranean Action Plan: http://pap-thecoastcentre.org

---